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Mutschler, III et al.

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[54] **METHOD FOR EXTENDING THE HYPERTEXT MARKUP LANGUAGE (HTML) TO SUPPORT ENTERPRISE APPLICATION DATA BINDING**

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[51] **Int. Cl.**[6] **G06F 3/00**

[52] **U.S. Cl.** **345/335**; 345/356

[58] **Field of Search** 345/335, 356, 345/357, 327, 326, 328, 329, 330–334, 336, 337–338, 339, 340–347, 398–399; 348/352–355, 466; 707/102–103, 500–514

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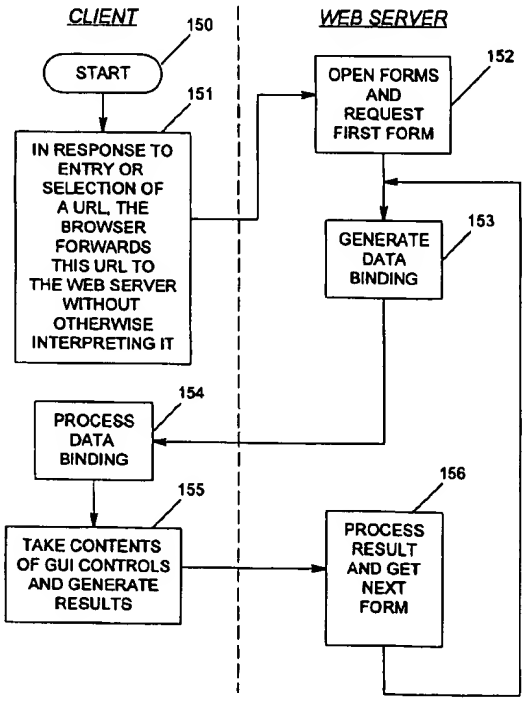
Attorney, Agent, or Firm—J. Ronald Richebourg; Steven R. Petersen; Mark T. Starr

[57] **ABSTRACT**

A method operating in a computing system that has at least one server and a multiplicity of clients coupled thereto. The server has a CPU executing a Web Server program and a repository coupled thereto for storing description language of a Form to be displayed. The server is coupled to a host having a CPU executing a legacy application containing the Form. At least one of the clients executes a Web browser program. The method of the present invention operates in the server and the client for supporting enterprise application data binding. The method in the server includes the steps of opening the Forms and requesting a first Form and associating data names with data values received from the host and sending them to the client. The client then locates a corresponding GUI Control and makes an association between each of the data names and a corresponding GUI Control and obtains the contents of each of the corresponding GUI Controls associated with a data name and places data value/data name into a buffer, Next, the server processes the contents of the buffer and sends it to the host, whereby the GUI Controls are displayed containing values and states from the Form.

18 Claims, 18 Drawing Sheets



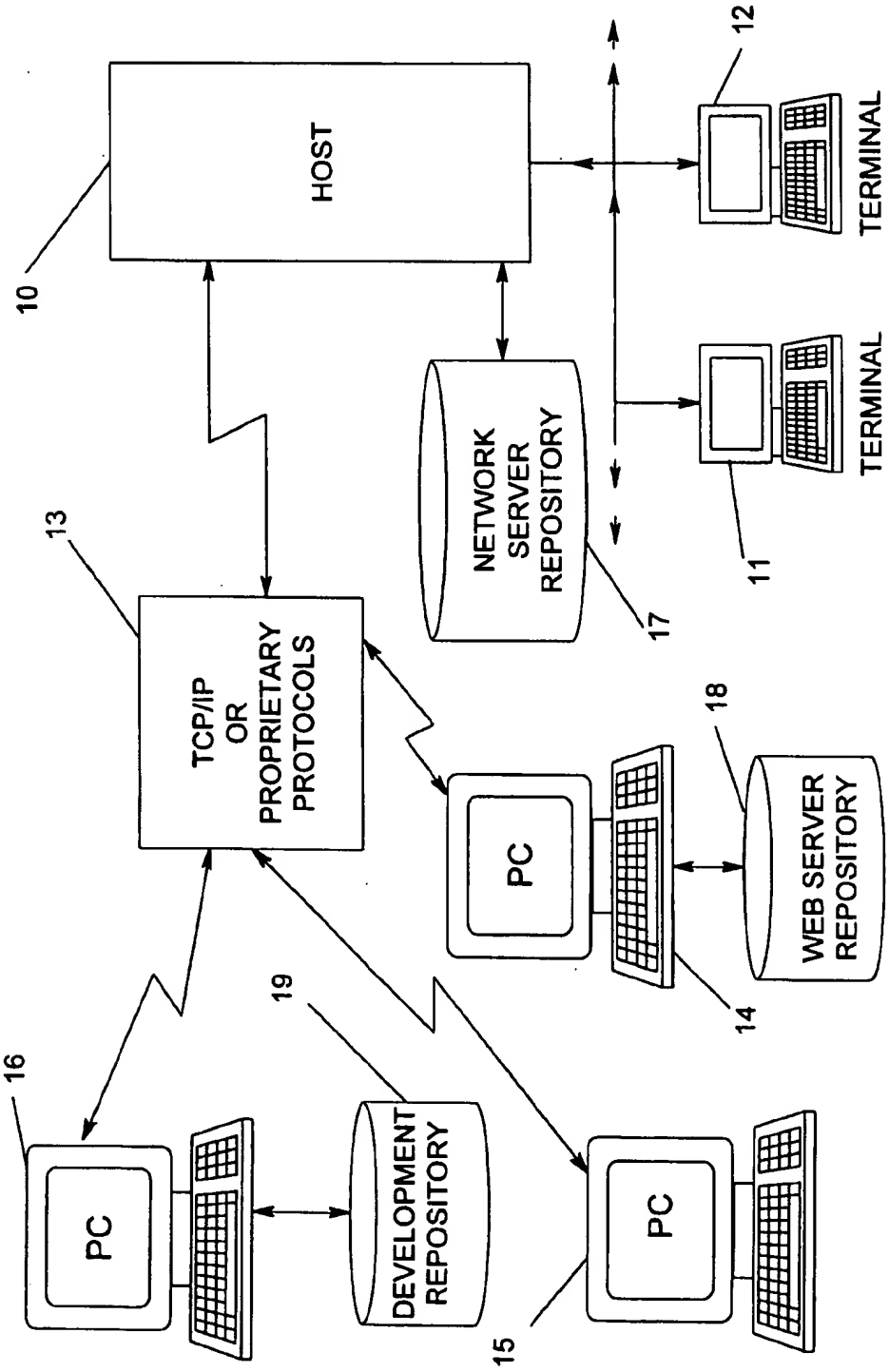

HOST
10
12
TERMINAL
TERMINAL
11
NETWORK SERVER REPOSITORY
17
13
TCP/IP OR PROPRIETARY PROTOCOLS
PC
18
WEB SERVER REPOSITORY
14
19
16
PC
DEVELOPMENT REPOSITORY
15
PC

FIG. 1

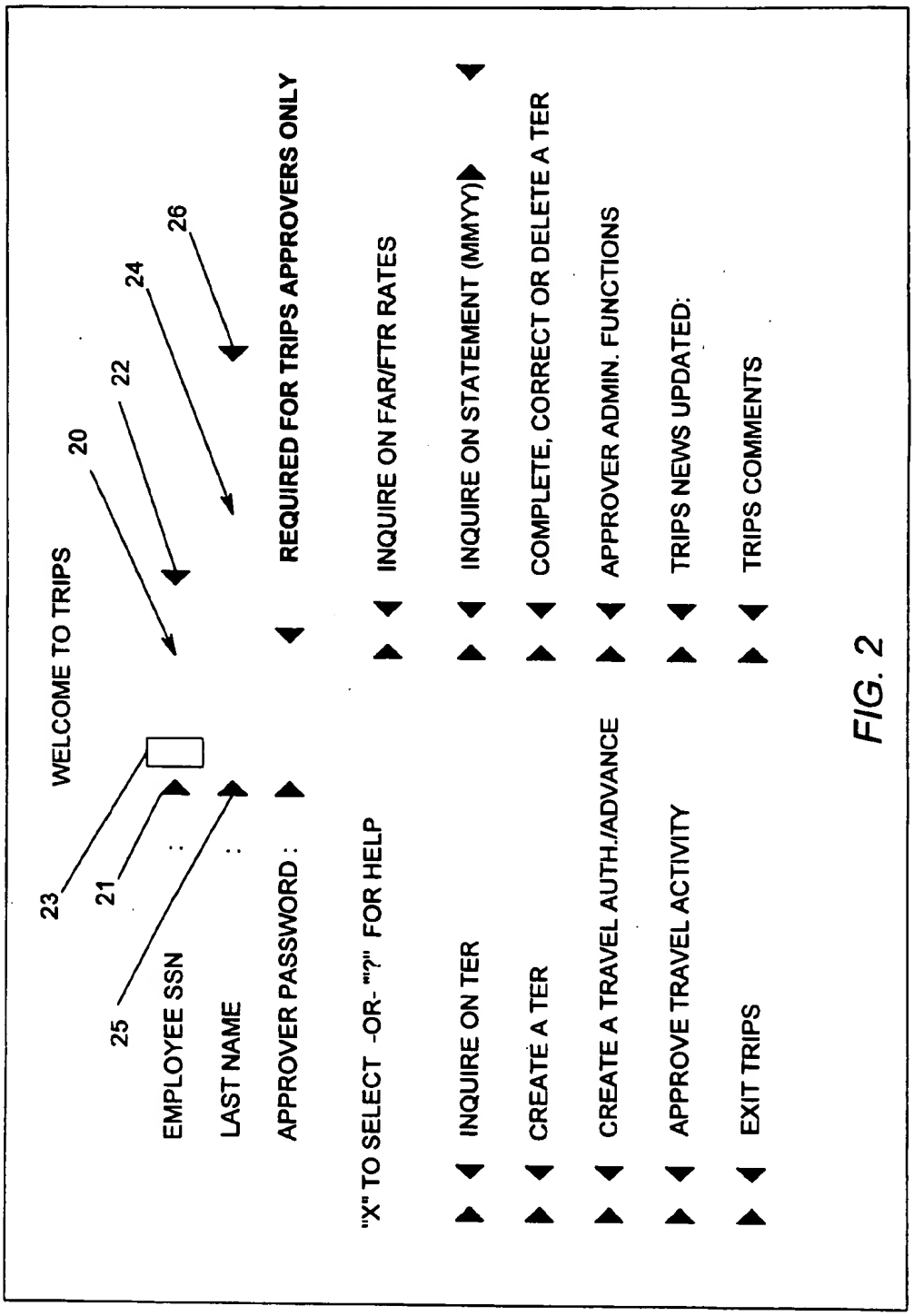

WELCOME TO TRIPS
EMPLOYEE SSN
LAST NAME
APPROVER PASSWORD :
REQUIRED FOR TRIPS APPROVERS ONLY
"X" TO SELECT -OR- "?" FOR HELP
INQUIRE ON FAR/FTR RATES
INQUIRE ON TER
INQUIRE ON STATEMENT (MMYY)
CREATE A TER
COMPLETE, CORRECT OR DELETE A TER
CREATE A TRAVEL AUTH./ADVANCE
APPROVER ADMIN. FUNCTIONS
APPROVE TRAVEL ACTIVITY
TRIPS NEWS UPDATED:
EXIT TRIPS
TRIPS COMMENTS
20
21
22
23
24
25
26

FIG. 2

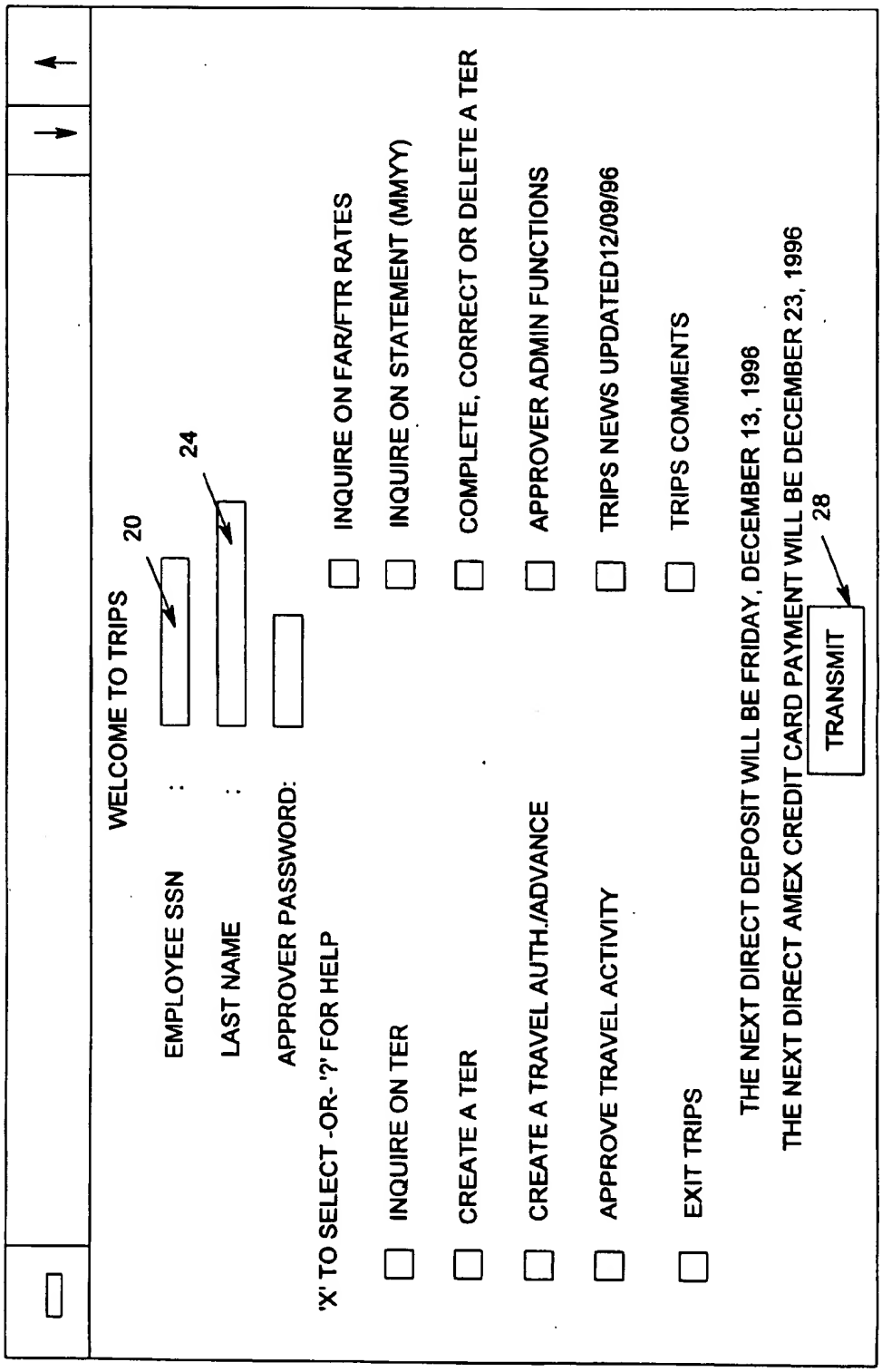
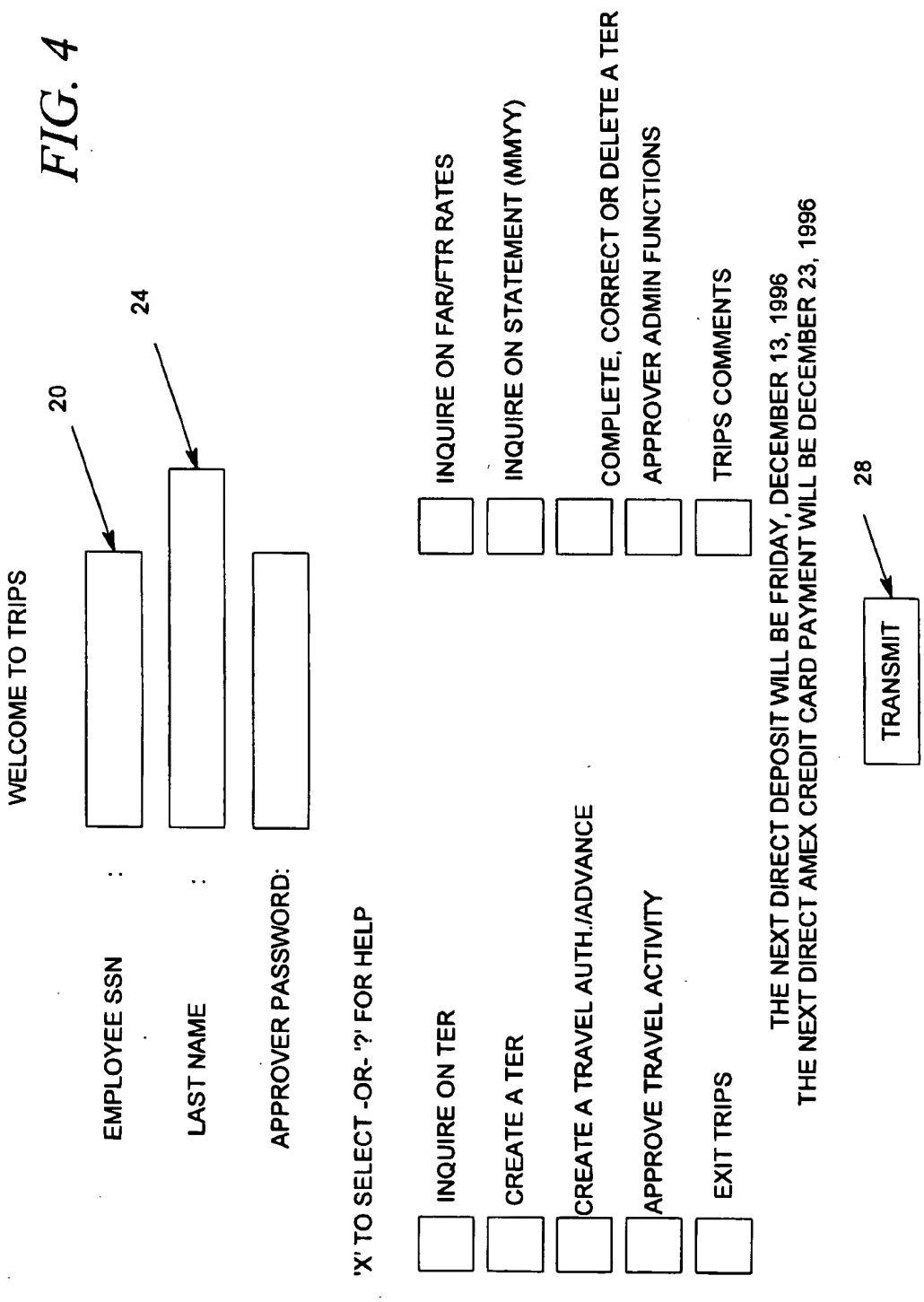

WELCOME TO TRIPS
EMPLOYEE SSN :
LAST NAME :
APPROVER PASSWORD:
'X' TO SELECT -OR- '?' FOR HELP
INQUIRE ON TER
CREATE A TER
CREATE A TRAVEL AUTH./ADVANCE
APPROVE TRAVEL ACTIVITY
EXIT TRIPS
INQUIRE ON FAR/FTR RATES
INQUIRE ON STATEMENT (MMYY)
COMPLETE, CORRECT OR DELETE A TER
APPROVER ADMIN FUNCTIONS
TRIPS NEWS UPDATED12/09/96
TRIPS COMMENTS
THE NEXT DIRECT DEPOSIT WILL BE FRIDAY, DECEMBER 13, 1996
THE NEXT DIRECT AMEX CREDIT CARD PAYMENT WILL BE DECEMBER 23, 1996
TRANSMIT
20
24
28

FIG. 3

FIG. 4


WELCOME TO TRIPS
20
24
EMPLOYEE SSN
LAST NAME
APPROVER PASSWORD:
'X' TO SELECT -OR- '?' FOR HELP
INQUIRE ON TER
CREATE A TER
CREATE A TRAVEL AUTH./ADVANCE
APPROVE TRAVEL ACTIVITY
EXIT TRIPS
INQUIRE ON FAR/FTR RATES
INQUIRE ON STATEMENT (MMYY)
COMPLETE, CORRECT OR DELETE A TER
APPROVER ADMIN FUNCTIONS
TRIPS COMMENTS
THE NEXT DIRECT DEPOSIT WILL BE FRIDAY, DECEMBER 13, 1996
THE NEXT DIRECT AMEX CREDIT CARD PAYMENT WILL BE DECEMBER 23, 1996
28
TRANSMIT

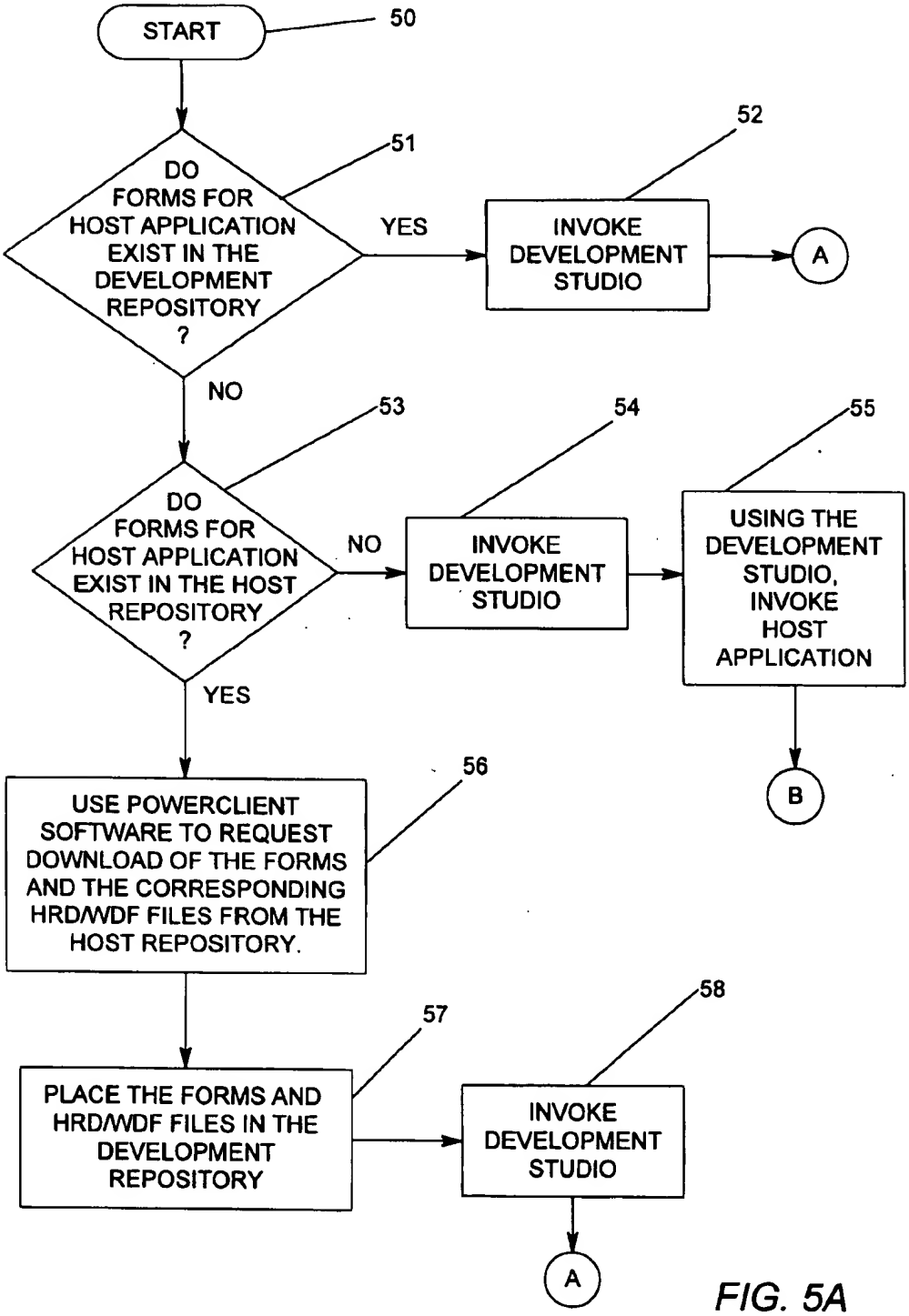

START
50
DO FORMS FOR HOST APPLICATION EXIST IN THE DEVELOPMENT REPOSITORY ?
51
YES
INVOKE DEVELOPMENT STUDIO
52
A
NO
DO FORMS FOR HOST APPLICATION EXIST IN THE HOST REPOSITORY ?
53
NO
INVOKE DEVELOPMENT STUDIO
54
USING THE DEVELOPMENT STUDIO, INVOKE HOST APPLICATION
55
B
YES
USE POWERCLIENT SOFTWARE TO REQUEST DOWNLOAD OF THE FORMS AND THE CORRESPONDING HRD/WDF FILES FROM THE HOST REPOSITORY.
56
PLACE THE FORMS AND HRD/WDF FILES IN THE DEVELOPMENT REPOSITORY
57
INVOKE DEVELOPMENT STUDIO
58
A

FIG. 5A

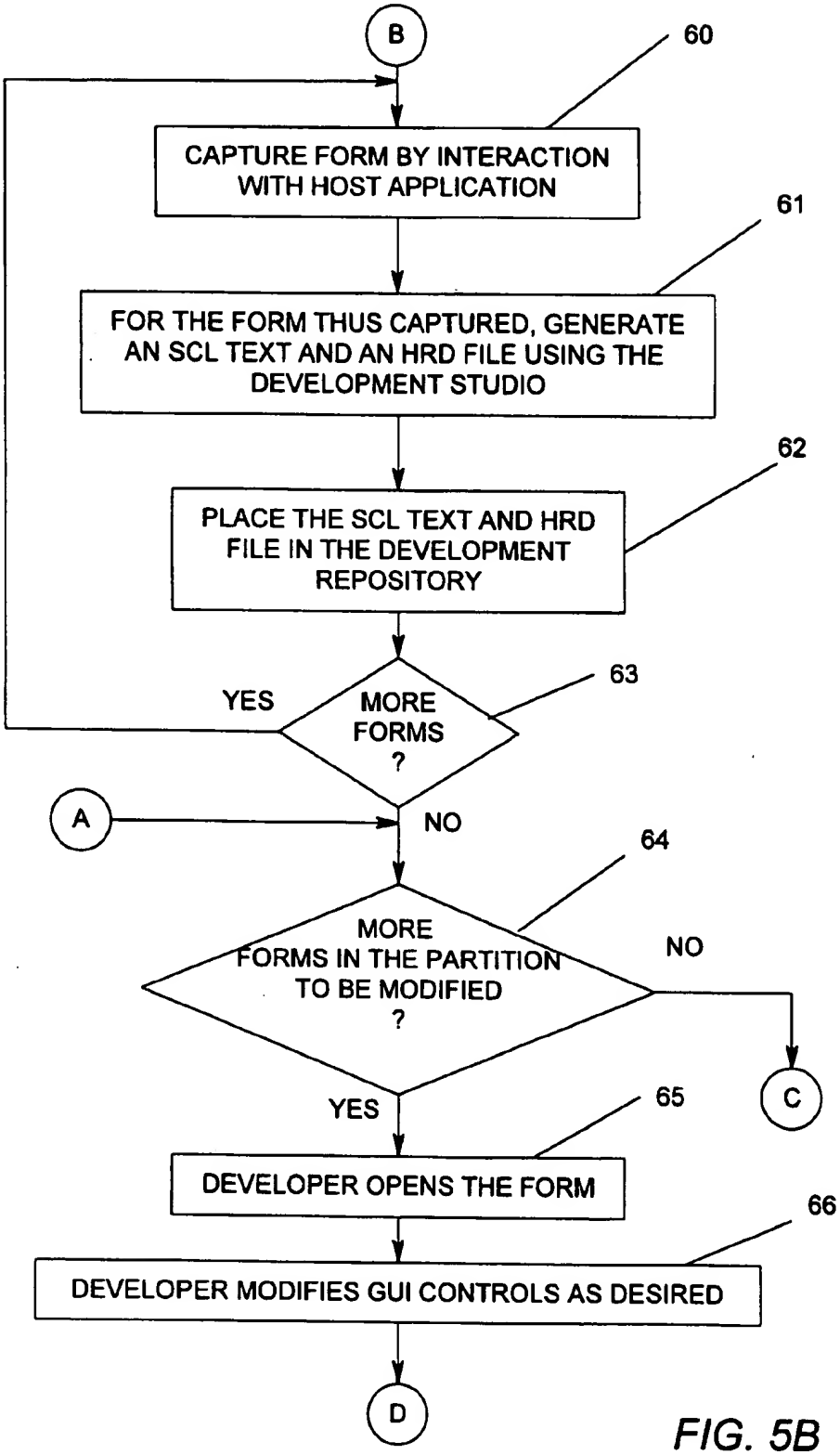

B
60
CAPTURE FORM BY INTERACTION WITH HOST APPLICATION
61
FOR THE FORM THUS CAPTURED, GENERATE AN SCL TEXT AND AN HRD FILE USING THE DEVELOPMENT STUDIO
62
PLACE THE SCL TEXT AND HRD FILE IN THE DEVELOPMENT REPOSITORY
63
YES
MORE FORMS ?
A
NO
64
MORE FORMS IN THE PARTITION TO BE MODIFIED ?
NO
C
YES
65
DEVELOPER OPENS THE FORM
66
DEVELOPER MODIFIES GUI CONTROLS AS DESIRED
D

FIG. 5B

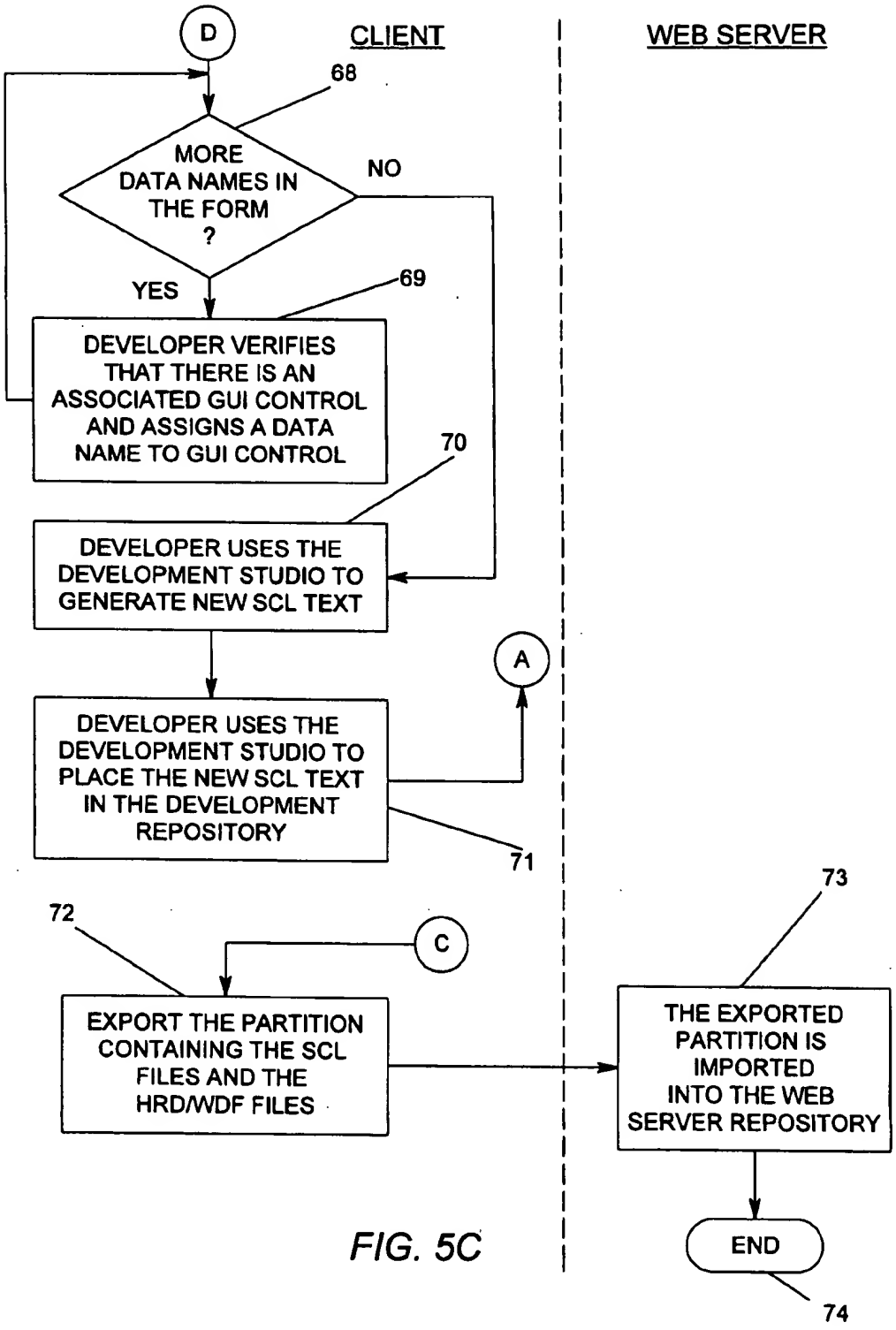

D
CLIENT
WEB SERVER
68
MORE DATA NAMES IN THE FORM ?
NO
YES
69
DEVELOPER VERIFIES THAT THERE IS AN ASSOCIATED GUI CONTROL AND ASSIGNS A DATA NAME TO GUI CONTROL
70
DEVELOPER USES THE DEVELOPMENT STUDIO TO GENERATE NEW SCL TEXT
A
DEVELOPER USES THE DEVELOPMENT STUDIO TO PLACE THE NEW SCL TEXT IN THE DEVELOPMENT REPOSITORY
71
72
C
EXPORT THE PARTITION CONTAINING THE SCL FILES AND THE HRD/WDF FILES
73
THE EXPORTED PARTITION IS IMPORTED INTO THE WEB SERVER REPOSITORY
END
74

FIG. 5C

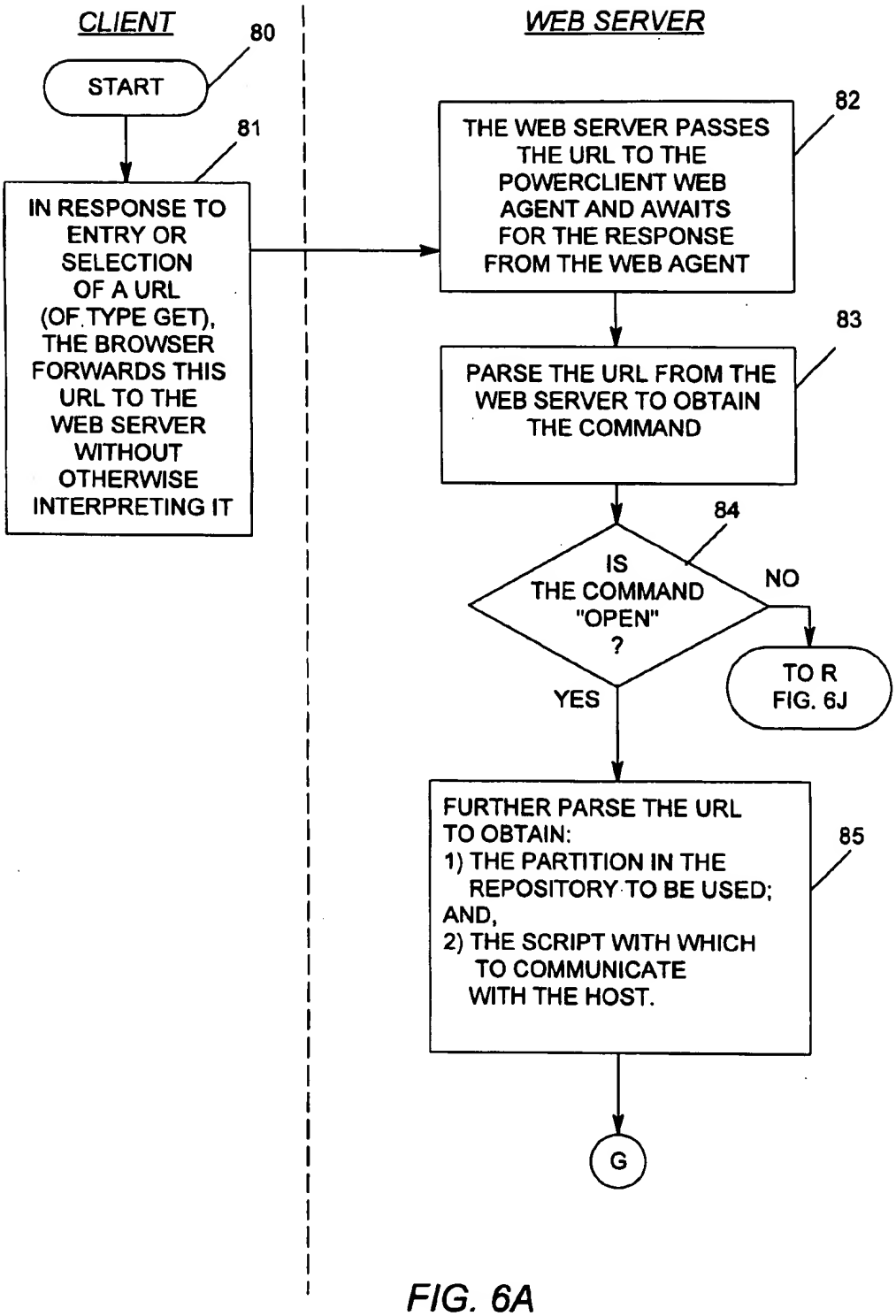

CLIENT
WEB SERVER
80
START
81
IN RESPONSE TO ENTRY OR SELECTION OF A URL (OF TYPE GET), THE BROWSER FORWARDS THIS URL TO THE WEB SERVER WITHOUT OTHERWISE INTERPRETING IT
82
THE WEB SERVER PASSES THE URL TO THE POWERCLIENT WEB AGENT AND AWAITS FOR THE RESPONSE FROM THE WEB AGENT
83
PARSE THE URL FROM THE WEB SERVER TO OBTAIN THE COMMAND
84
IS THE COMMAND "OPEN" ?
NO
TO R FIG. 6J
YES
FURTHER PARSE THE URL TO OBTAIN:
1) THE PARTITION IN THE REPOSITORY TO BE USED; AND,
2) THE SCRIPT WITH WHICH TO COMMUNICATE WITH THE HOST.
85
G

FIG. 6A

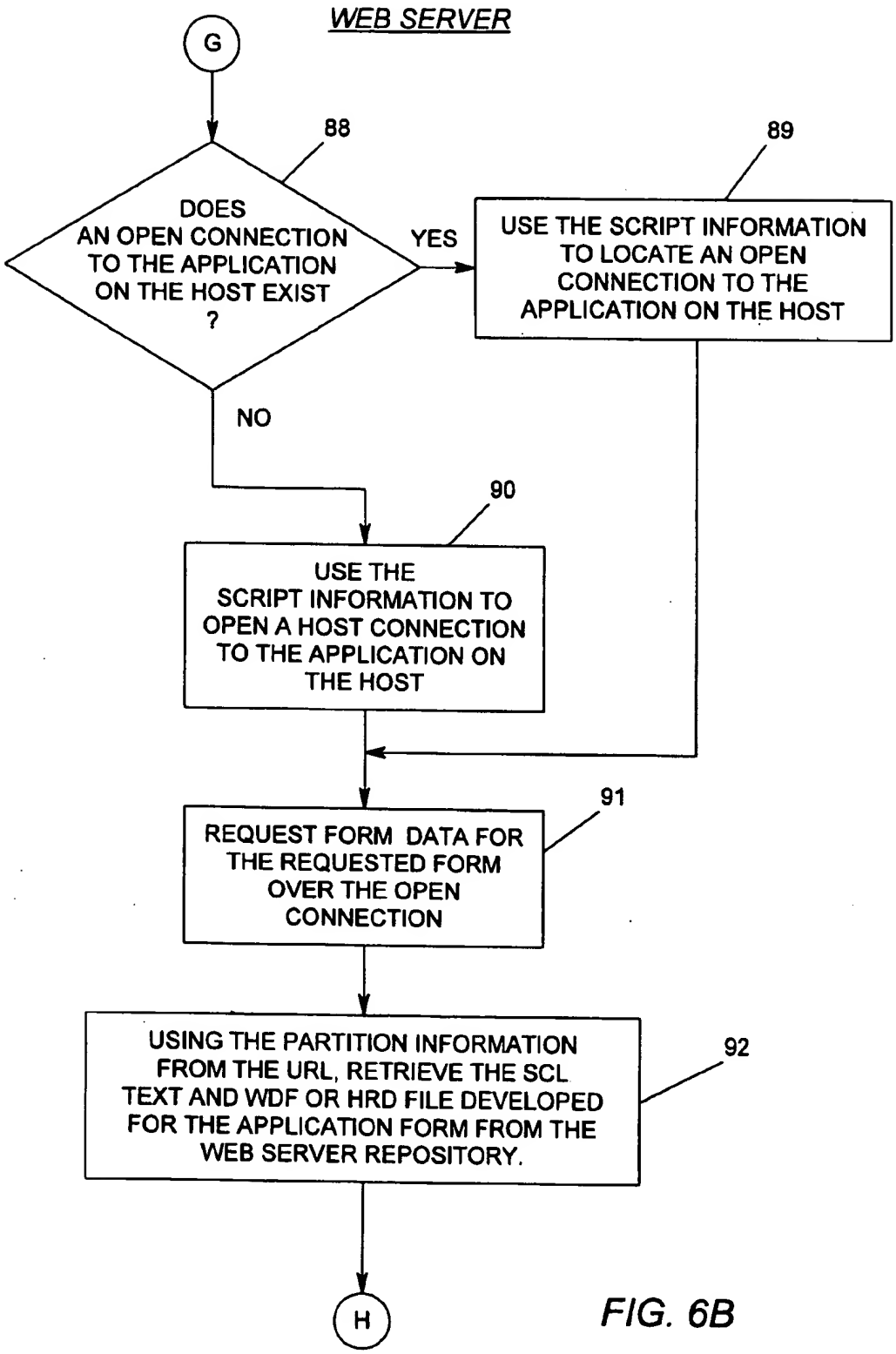

WEB SERVER
G
88
DOES AN OPEN CONNECTION TO THE APPLICATION ON THE HOST EXIST ?
YES
89
USE THE SCRIPT INFORMATION TO LOCATE AN OPEN CONNECTION TO THE APPLICATION ON THE HOST
NO
90
USE THE SCRIPT INFORMATION TO OPEN A HOST CONNECTION TO THE APPLICATION ON THE HOST
91
REQUEST FORM DATA FOR THE REQUESTED FORM OVER THE OPEN CONNECTION
USING THE PARTITION INFORMATION FROM THE URL, RETRIEVE THE SCL TEXT AND WDF OR HRD FILE DEVELOPED FOR THE APPLICATION FORM FROM THE WEB SERVER REPOSITORY.
92
H

FIG. 6B

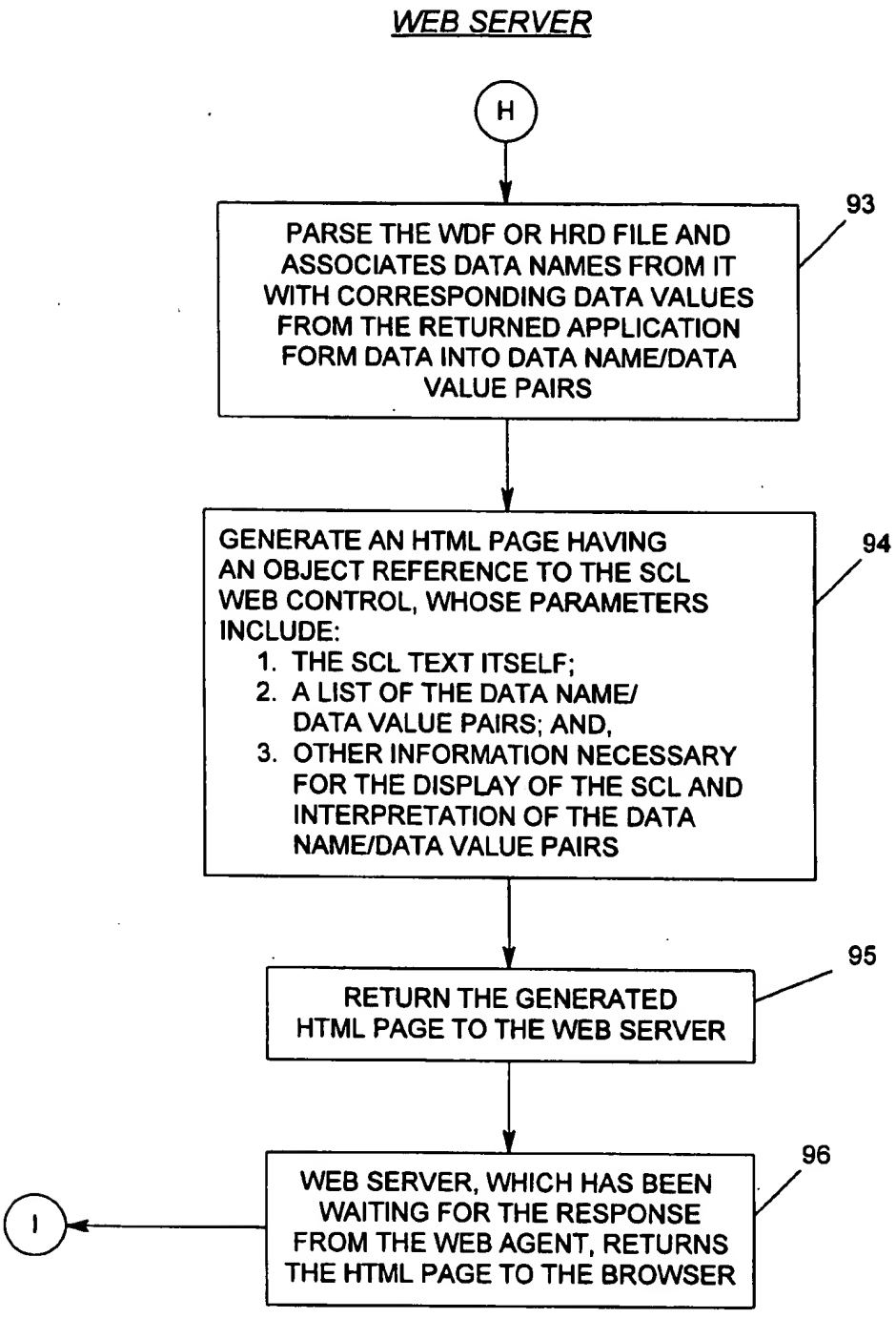

WEB SERVER
H
PARSE THE WDF OR HRD FILE AND ASSOCIATES DATA NAMES FROM IT WITH CORRESPONDING DATA VALUES FROM THE RETURNED APPLICATION FORM DATA INTO DATA NAME/DATA VALUE PAIRS
93
GENERATE AN HTML PAGE HAVING AN OBJECT REFERENCE TO THE SCL WEB CONTROL, WHOSE PARAMETERS INCLUDE:
1. THE SCL TEXT ITSELF;
2. A LIST OF THE DATA NAME/ DATA VALUE PAIRS; AND,
3. OTHER INFORMATION NECESSARY FOR THE DISPLAY OF THE SCL AND INTERPRETATION OF THE DATA NAME/DATA VALUE PAIRS
94
RETURN THE GENERATED HTML PAGE TO THE WEB SERVER
95
WEB SERVER, WHICH HAS BEEN WAITING FOR THE RESPONSE FROM THE WEB AGENT, RETURNS THE HTML PAGE TO THE BROWSER
96
I

FIG. 6C

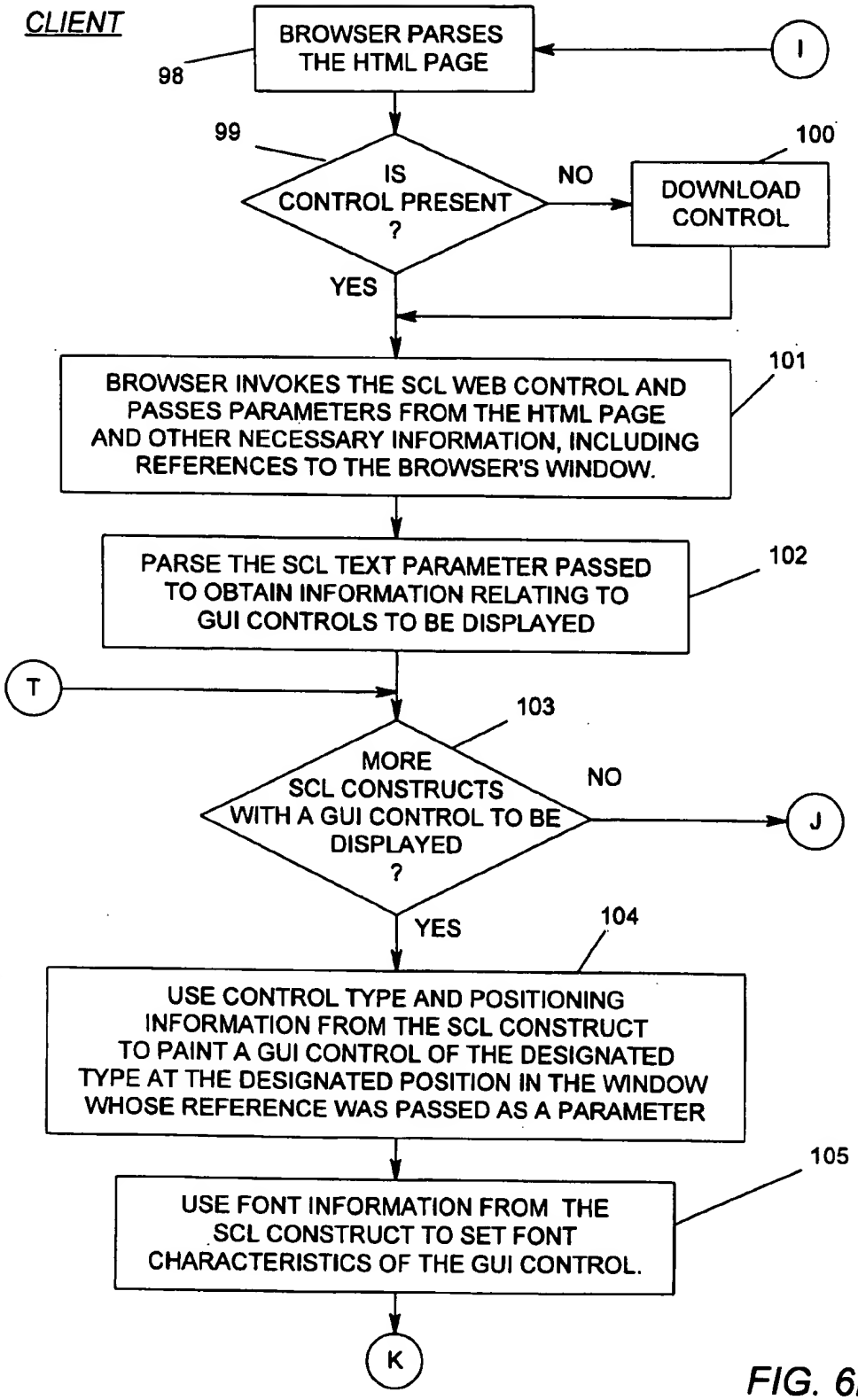

CLIENT
BROWSER PARSES THE HTML PAGE
98
I
99
IS CONTROL PRESENT ?
NO
100
DOWNLOAD CONTROL
YES
BROWSER INVOKES THE SCL WEB CONTROL AND PASSES PARAMETERS FROM THE HTML PAGE AND OTHER NECESSARY INFORMATION, INCLUDING REFERENCES TO THE BROWSER'S WINDOW.
101
PARSE THE SCL TEXT PARAMETER PASSED TO OBTAIN INFORMATION RELATING TO GUI CONTROLS TO BE DISPLAYED
102
T
103
MORE SCL CONSTRUCTS WITH A GUI CONTROL TO BE DISPLAYED ?
NO
J
YES
104
USE CONTROL TYPE AND POSITIONING INFORMATION FROM THE SCL CONSTRUCT TO PAINT A GUI CONTROL OF THE DESIGNATED TYPE AT THE DESIGNATED POSITION IN THE WINDOW WHOSE REFERENCE WAS PASSED AS A PARAMETER
105
USE FONT INFORMATION FROM THE SCL CONSTRUCT TO SET FONT CHARACTERISTICS OF THE GUI CONTROL.
K

FIG. 6D

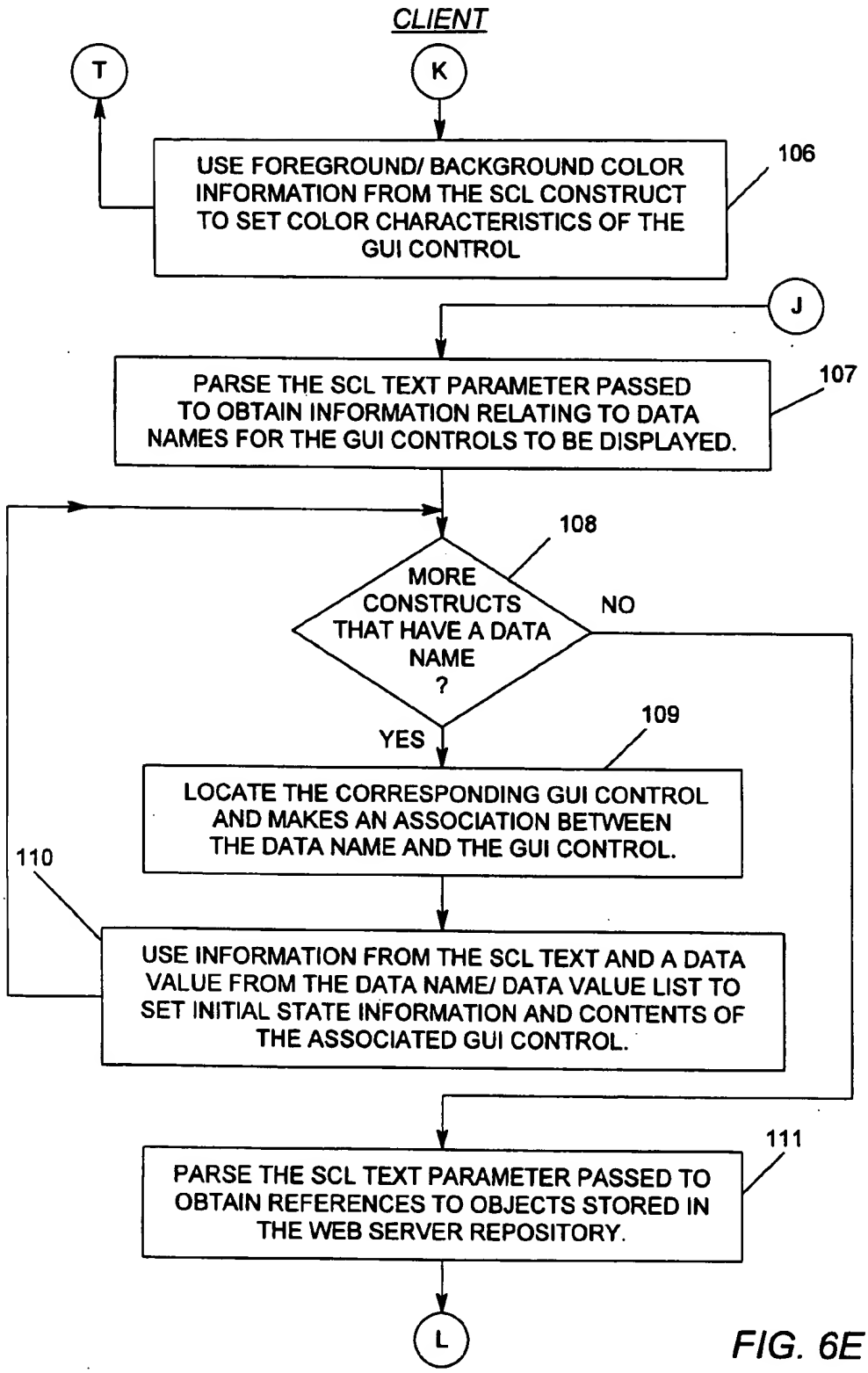

CLIENT
T
K
USE FOREGROUND/ BACKGROUND COLOR INFORMATION FROM THE SCL CONSTRUCT TO SET COLOR CHARACTERISTICS OF THE GUI CONTROL
106
J
PARSE THE SCL TEXT PARAMETER PASSED TO OBTAIN INFORMATION RELATING TO DATA NAMES FOR THE GUI CONTROLS TO BE DISPLAYED.
107
108
MORE CONSTRUCTS THAT HAVE A DATA NAME ?
NO
YES
109
LOCATE THE CORRESPONDING GUI CONTROL AND MAKES AN ASSOCIATION BETWEEN THE DATA NAME AND THE GUI CONTROL.
110
USE INFORMATION FROM THE SCL TEXT AND A DATA VALUE FROM THE DATA NAME/ DATA VALUE LIST TO SET INITIAL STATE INFORMATION AND CONTENTS OF THE ASSOCIATED GUI CONTROL.
111
PARSE THE SCL TEXT PARAMETER PASSED TO OBTAIN REFERENCES TO OBJECTS STORED IN THE WEB SERVER REPOSITORY.
L

FIG. 6E

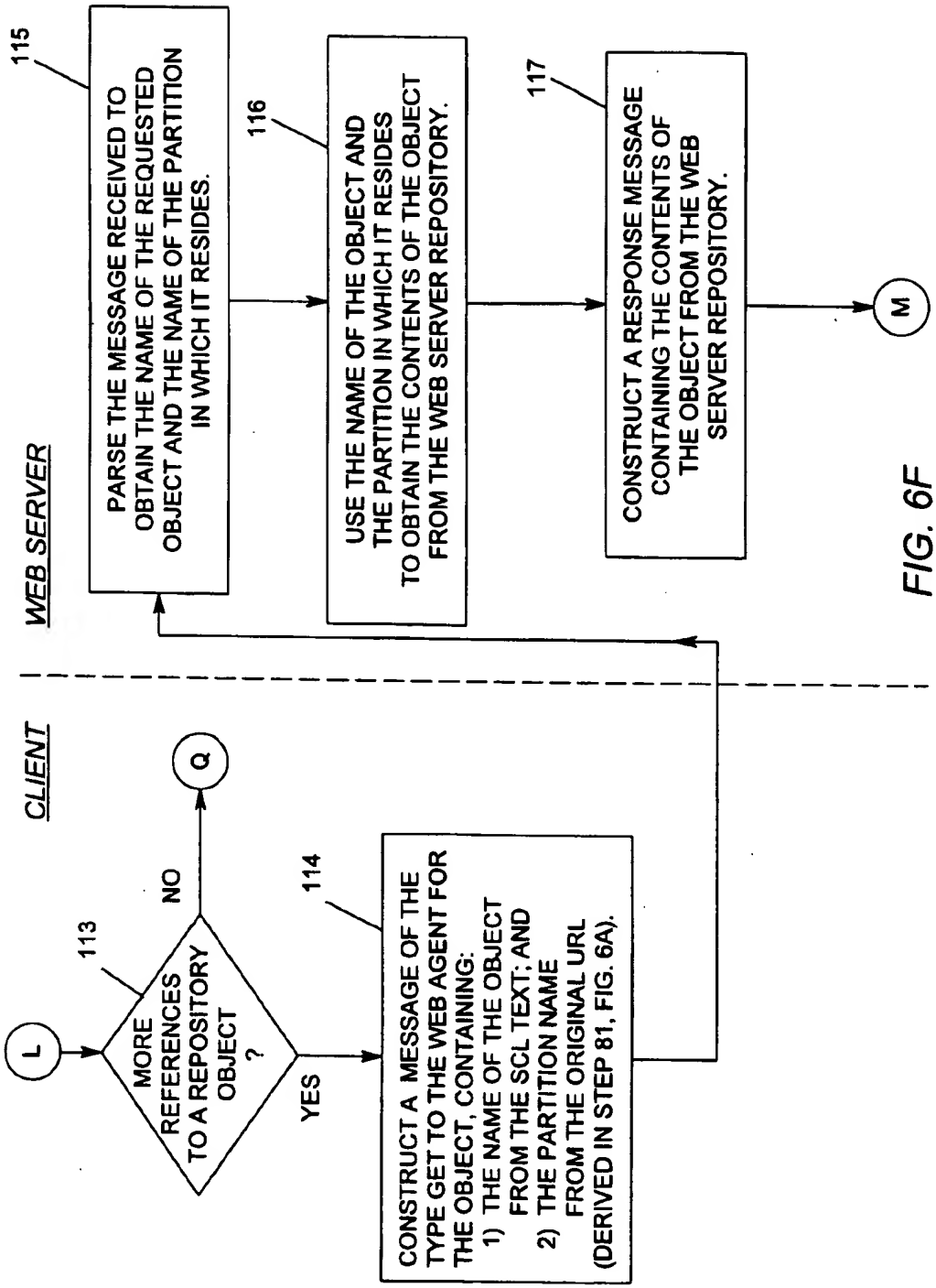

CLIENT
WEB SERVER
L
113
MORE REFERENCES TO A REPOSITORY OBJECT ?
NO
Q
YES
114
CONSTRUCT A MESSAGE OF THE TYPE GET TO THE WEB AGENT FOR THE OBJECT, CONTAINING:
1) THE NAME OF THE OBJECT FROM THE SCL TEXT; AND
2) THE PARTITION NAME FROM THE ORIGINAL URL (DERIVED IN STEP 81, FIG. 6A).
115
PARSE THE MESSAGE RECEIVED TO OBTAIN THE NAME OF THE REQUESTED OBJECT AND THE NAME OF THE PARTITION IN WHICH IT RESIDES.
116
USE THE NAME OF THE OBJECT AND THE PARTITION IN WHICH IT RESIDES TO OBTAIN THE CONTENTS OF THE OBJECT FROM THE WEB SERVER REPOSITORY.
117
CONSTRUCT A RESPONSE MESSAGE CONTAINING THE CONTENTS OF THE OBJECT FROM THE WEB SERVER REPOSITORY.
M

FIG. 6F

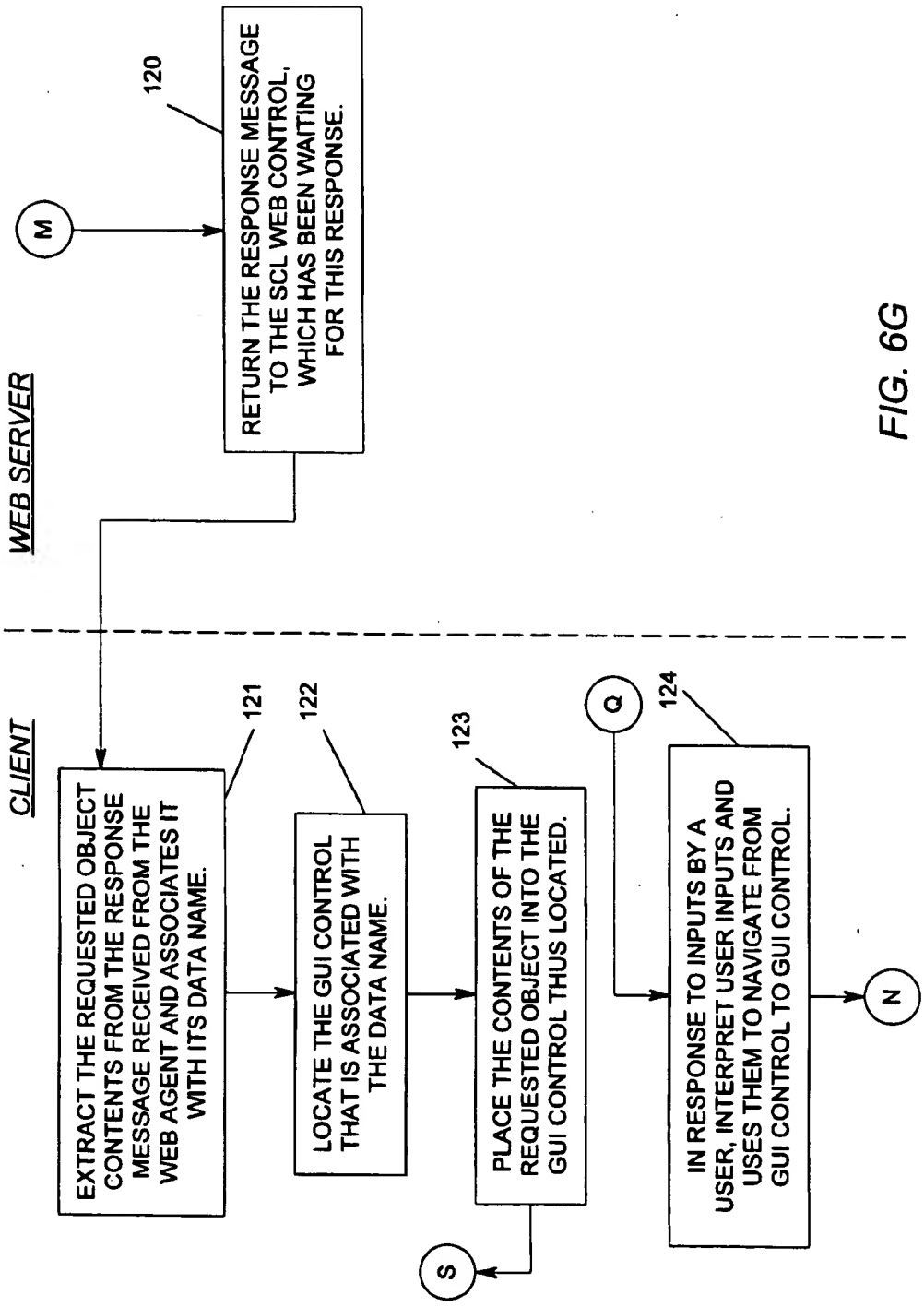

WEB SERVER
CLIENT
M
120
RETURN THE RESPONSE MESSAGE TO THE SCL WEB CONTROL, WHICH HAS BEEN WAITING FOR THIS RESPONSE.
121
EXTRACT THE REQUESTED OBJECT CONTENTS FROM THE RESPONSE MESSAGE RECEIVED FROM THE WEB AGENT AND ASSOCIATES IT WITH ITS DATA NAME.
122
LOCATE THE GUI CONTROL THAT IS ASSOCIATED WITH THE DATA NAME.
123
PLACE THE CONTENTS OF THE REQUESTED OBJECT INTO THE GUI CONTROL THUS LOCATED.
S
Q
124
IN RESPONSE TO INPUTS BY A USER, INTERPRET USER INPUTS AND USES THEM TO NAVIGATE FROM GUI CONTROL TO GUI CONTROL.
N

FIG. 6G

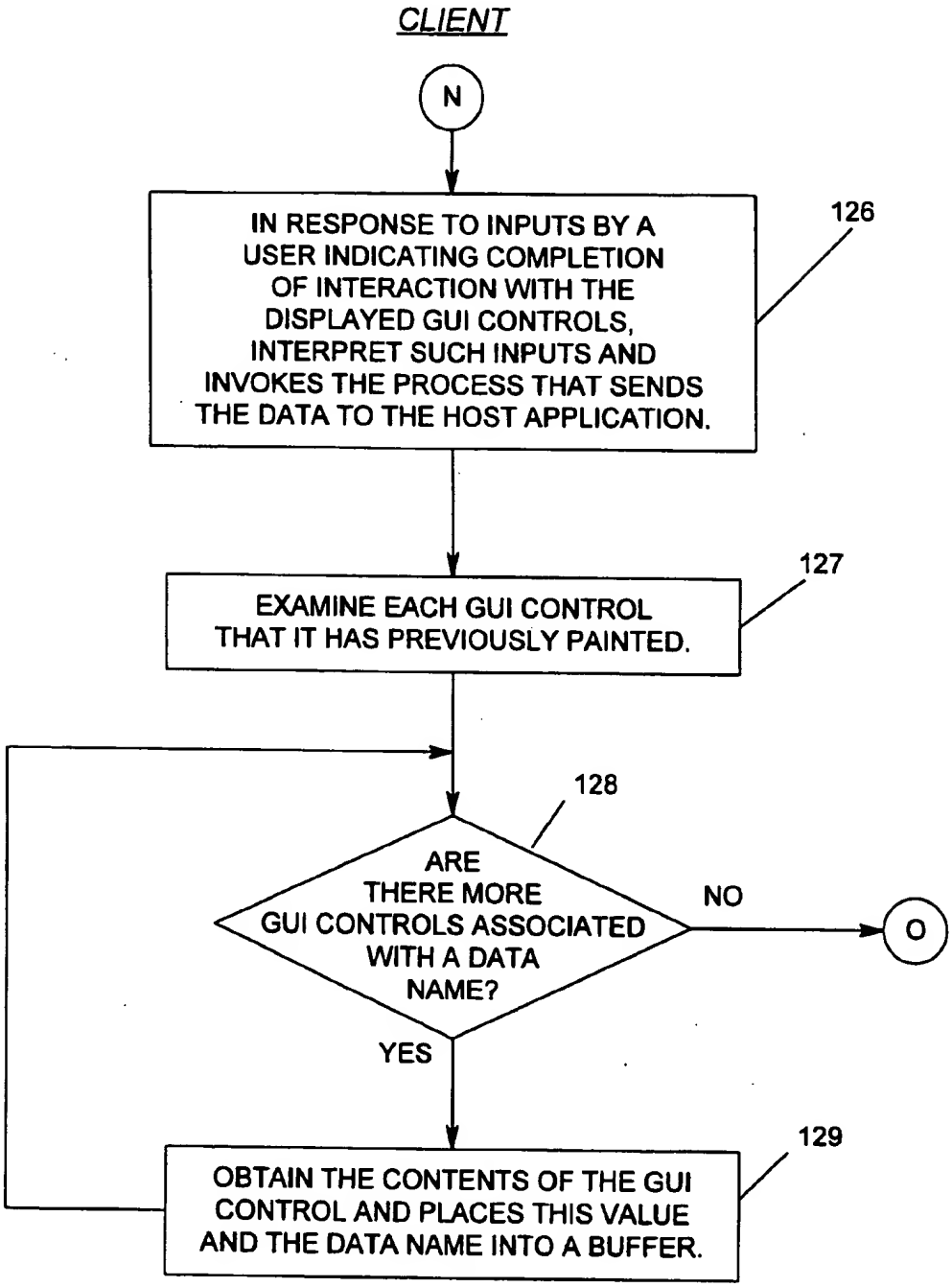

CLIENT
N
IN RESPONSE TO INPUTS BY A USER INDICATING COMPLETION OF INTERACTION WITH THE DISPLAYED GUI CONTROLS, INTERPRET SUCH INPUTS AND INVOKES THE PROCESS THAT SENDS THE DATA TO THE HOST APPLICATION.
126
EXAMINE EACH GUI CONTROL THAT IT HAS PREVIOUSLY PAINTED.
127
128
ARE THERE MORE GUI CONTROLS ASSOCIATED WITH A DATA NAME?
NO
O
YES
OBTAIN THE CONTENTS OF THE GUI CONTROL AND PLACES THIS VALUE AND THE DATA NAME INTO A BUFFER.
129

FIG. 6H

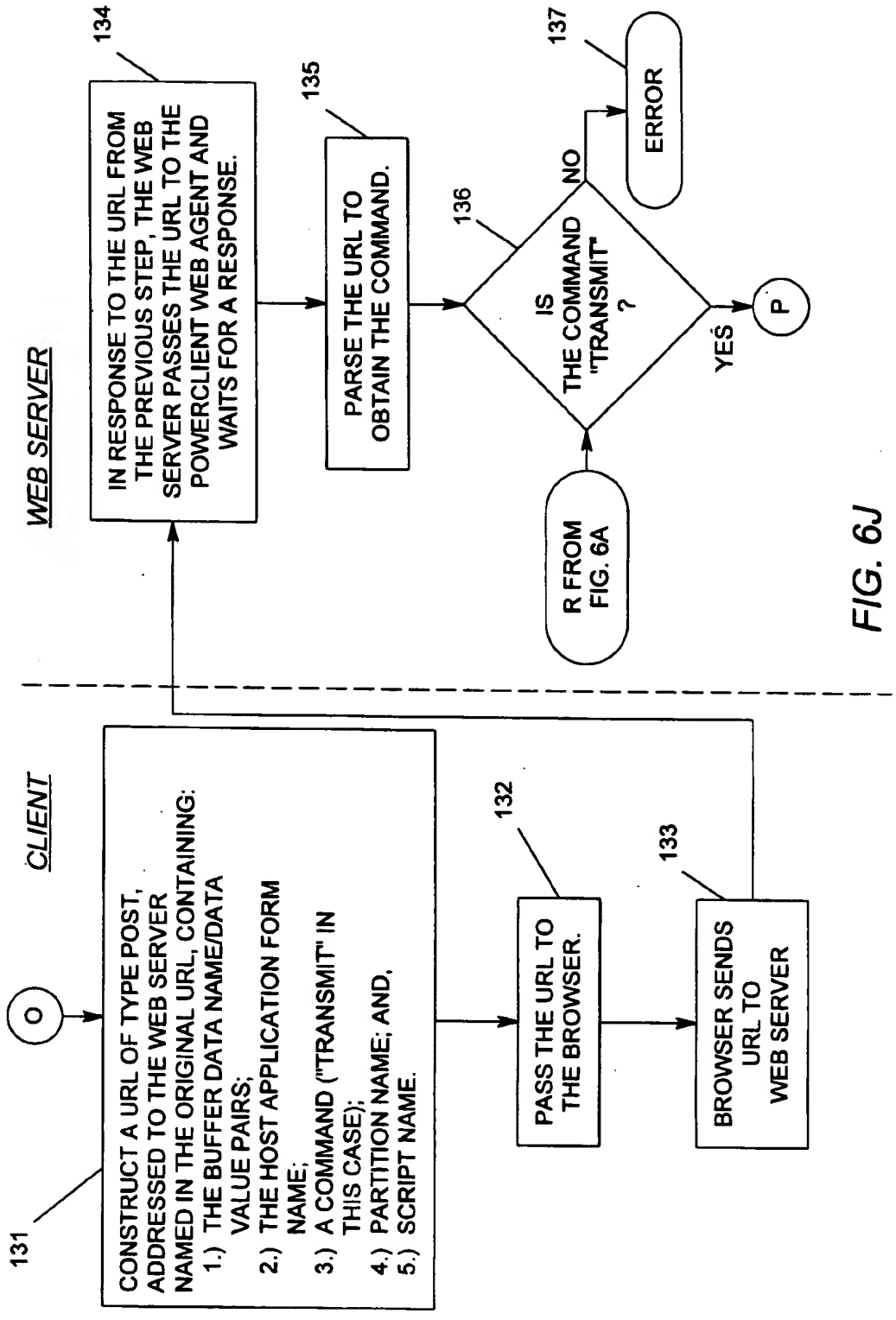

CLIENT
WEB SERVER
O
131
CONSTRUCT A URL OF TYPE POST, ADDRESSED TO THE WEB SERVER NAMED IN THE ORIGINAL URL, CONTAINING:
1.) THE BUFFER DATA NAME/DATA VALUE PAIRS;
2.) THE HOST APPLICATION FORM NAME;
3.) A COMMAND ("TRANSMIT" IN THIS CASE);
4.) PARTITION NAME; AND,
5.) SCRIPT NAME.
132
PASS THE URL TO THE BROWSER.
133
BROWSER SENDS URL TO WEB SERVER
134
IN RESPONSE TO THE URL FROM THE PREVIOUS STEP, THE WEB SERVER PASSES THE URL TO THE POWERCLIENT WEB AGENT AND WAITS FOR A RESPONSE.
135
PARSE THE URL TO OBTAIN THE COMMAND.
136
IS THE COMMAND "TRANSMIT" ?
NO
137
ERROR
YES
P
R FROM FIG. 6A

FIG. 6J

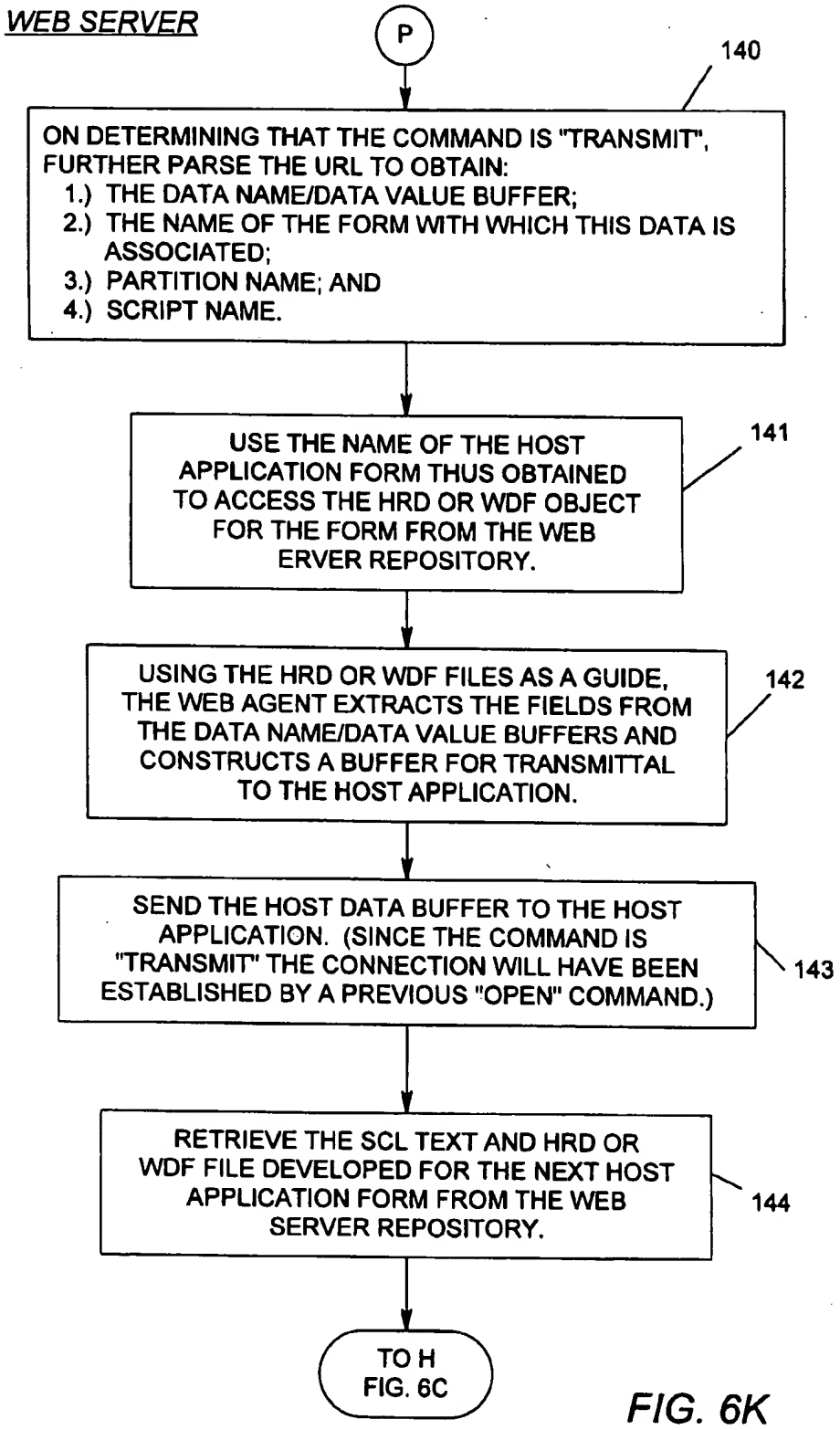

WEB SERVER
P
140
ON DETERMINING THAT THE COMMAND IS "TRANSMIT", FURTHER PARSE THE URL TO OBTAIN:
1.) THE DATA NAME/DATA VALUE BUFFER;
2.) THE NAME OF THE FORM WITH WHICH THIS DATA IS ASSOCIATED;
3.) PARTITION NAME; AND
4.) SCRIPT NAME.
USE THE NAME OF THE HOST APPLICATION FORM THUS OBTAINED TO ACCESS THE HRD OR WDF OBJECT FOR THE FORM FROM THE WEB ERVER REPOSITORY.
141
USING THE HRD OR WDF FILES AS A GUIDE, THE WEB AGENT EXTRACTS THE FIELDS FROM THE DATA NAME/DATA VALUE BUFFERS AND CONSTRUCTS A BUFFER FOR TRANSMITTAL TO THE HOST APPLICATION.
142
SEND THE HOST DATA BUFFER TO THE HOST APPLICATION. (SINCE THE COMMAND IS "TRANSMIT" THE CONNECTION WILL HAVE BEEN ESTABLISHED BY A PREVIOUS "OPEN" COMMAND.)
143
RETRIEVE THE SCL TEXT AND HRD OR WDF FILE DEVELOPED FOR THE NEXT HOST APPLICATION FORM FROM THE WEB SERVER REPOSITORY.
144
TO H FIG. 6C

FIG. 6K

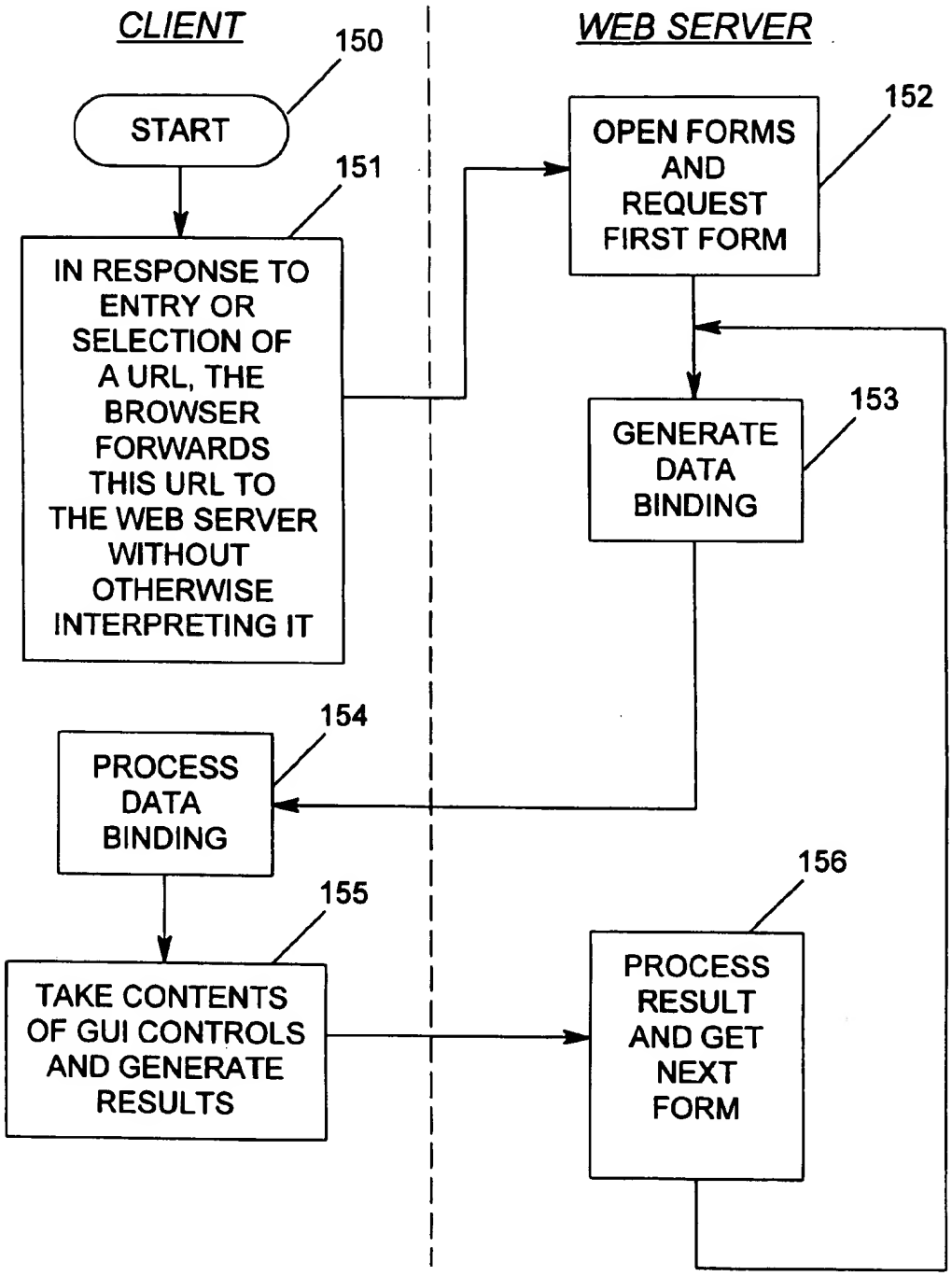

CLIENT
WEB SERVER
150
START
151
IN RESPONSE TO ENTRY OR SELECTION OF A URL, THE BROWSER FORWARDS THIS URL TO THE WEB SERVER WITHOUT OTHERWISE INTERPRETING IT
152
OPEN FORMS AND REQUEST FIRST FORM
153
GENERATE DATA BINDING
154
PROCESS DATA BINDING
155
TAKE CONTENTS OF GUI CONTROLS AND GENERATE RESULTS
156
PROCESS RESULT AND GET NEXT FORM

FIG. 7

METHOD FOR EXTENDING THE HYPERTEXT MARKUP LANGUAGE (HTML) TO SUPPORT ENTERPRISE APPLICATION DATA BINDING

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

This application relates to the following copending applications, assigned to the same assignee hereof, which are incorporated herein by reference.

U.S. Ser. No. 08/941,436, entitled A METHOD FOR DYNAMICALLY EMBEDDING OBJECTS STORED IN A WEB SERVER WITHIN HTML FOR DISPLAY BY A WEB BROWSER; and

U.S. Ser. No. 08/941,438, entitled A METHOD FOR EXTENDING HYPERTEXT MARKUP LANGUAGE (HTML) TO SUPPORT. A GRAPHICAL USER INTERFACE CONTROL PRESENTATION.

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FIELD OF THE INVENTION

The present invention generally relates to client/server computing in a World Wide Web ("Web") environment, and more particularly to a method for supporting enterprise application binding within a Web Browser.

BACKGROUND OF THE INVENTION

With the rising popularity of client/server computing and the Web, businesses are looking for even better ways to increase their competitive advantage. Information is one of businesses most precious commodities. Accordingly, there is a need for flexibility to position information in ways that best support business organizations and their customers.

Client/server technology offers graphical user interfaces (GUI's) a choice of open systems, rapid application development, increased end-user productivity and much more. By combining this technology with the Internet and intranets, a powerful system is made available to distribute information throughout the business and customer communities. The world Wide web is a purely client/server environment that can bring business to customers. Even if a business has information that needs to be kept within the organization, the Web technology is still available as an Intranet, which is a web site behind a firewall and made available only to employees of the organization. The term "firewall" as used herein refers to a combination of hardware and software that prevents access to secured data over a network. The idea is to protect a cluster of more loosely administered machines hidden behind the firewall from hackers.

There is also a need to make the move to client/server and Internet technologies without having to migrate from existing host applications. The best way to build new client/server applications that can be integrated with current applications is to combine the dependability of enterprise-wide computing systems with the flexibility of distributed processing.

Early attempts at capitalizing on the advantages of the client/server applications involved the use of the PC as a "dumb terminal", or a character-based network terminal,

that interacted directly with legacy programs operating on a mainframe or host computer. This approach was unsatisfactory because the user was limited to a character-mode display. Later attempts included such solutions as the Designer Workbench product (which is a software tool now referred to as PowerClient and available from Unisys Corporation, assignee of this patent). The PowerClient product gives the user the ability to capture Forms descriptions that are on the mainframe, and to convert character-based fields into Windows-based visual elements such as edit fields, buttons, etc. A language called SCL (Screen Control Language) was created for describing the visual elements as well as indicating processing that will be performed on the client PC's.

With reference to various types of legacy programs operating on the host, LINC (i.e., "Logical Information Network Compiler") allows Screen Control Language ("SCL") to be generated directly. SCL is created with the use of the PowerClient product for third generation languages (3GL) such as COBOL or ALGOL legacy programs; and, in the case of MAPPER, which is a third system and language for legacy programs, there is no way to generate SCL. For MAPPER, the user must use a forms designer tool (such as the Development Studio product) for drawing visual elements to generate the required SCL that matches the MAPPER application.

More recently, it was possible to take SCL definitions of a Form and turn them into a Visual Basic or a PowerBuilder executable program. For an amplification of this method reference is made to a copending patent application entitled A METHOD FOR GENERATING CODE FOR MODIFYING EXISTING EVENT ROUTINES FOR CONTROLS ON A FORM, Ser. No. 08/803,137, filed Feb. 19, 1997 by the same inventors hereof and assigned to the same assignee hereof. PowerBuilder is a product of PowerSoft Company (which has recently merged with Sybase, Inc. of Emeryville, Calif.), and Visual Basic is a product of Microsoft Corporation of Redmond, Wash. However, since the Visual Basic and PowerBuilder client builder products generate executables, there is no way to incorporate the presentation functionality they provide into a Web browser, which is a client-side software module for accessing a Web server.

The PowerClient product has the capability of displaying forms from legacy host applications in the PC environment. While it is possible to display forms in their original, character-based format, it is also possible, via the PowerClient Development Studio product, to add modern GUI Controls, such as command buttons, list boxes and images to these forms. The Forms thus developed are stored in the PowerClient product environment and are accessed and displayed as needed when the user is interacting with the legacy application. The initial data received from the legacy application for the Form is displayed, and then the user of the legacy application enters data into the GUI Controls contained in the Form. When the user completes the interaction, the PowerClient product gathers the data from these GUI controls into a buffer and formats it for transmission to the host in such a way that the legacy host application can continue to use its character-based interface and is unaware of these changes. The host legacy application then supplies the initial data for the next Form, and the process repeats.

In order to "Web-enable" such a legacy application, i.e. allow it to work within the World Wide Web internet or intranet environment, it is necessary that: 1) the host application continue to be unaware that an agency is intervening in the display of its Forms and 2) these Forms need to have

a "look and feel" similar to the PC version in order that development and training costs be minimized.

The current state of the art for displaying Forms in the World Wide Web is the Hypertext Markup Language (HTML). This language is an instance of SGML (Standard Generalized Markup Language). HTML has the concept of the FORM, which is a means of displaying GUI controls for user interaction. When the user submits the HTML Form, the contents of these controls are gathered by the Web browser and sent as part of a Universal Resource Locator (URL) sent to the Web server in the form of control name/control value pairs.

The HTML FORM construct was originally considered for implementation of PowerClient product Forms in the web environment and considerable effort was expended in an effort to make it work. However, it was ultimately found that there were numerous shortcomings of this approach, foremost of which is the inability to simultaneously specify the caption for a control and the name of the host data element with which it is associated. This limitation made it impossible to use the HTML FORM construct to support PowerClient product legacy forms in the web environment. Moreover, while the set of available components included most of the PowerClient product's GUI Control set, there were still some which either were not supported or were of limited functionality vis-a-vis the PowerClient product set. Additionally, there was no way to control where on the Form the control was positioned. HTML Version 2.0 added the concept of FRAMEs, which gives some control over positioning. These were evaluated for the PowerClient product's environment and found insufficient to control locations on the PowerClient product Form.

SUMMARY OF THE INVENTION

It is therefore an object of the method of the present invention to provide an evolutionary approach to client/server technology so that a user can retain their existing information technology investment in legacy programs, yet move to client/server computing on the Web. A user can increase productivity and reduce development and training costs because using the present invention does not require any changes to the legacy programs.

A feature of the present invention is that the generated SCL is dynamically embedded within the HyperText Markup Language (HTML) for each legacy Form.

Another feature of the present invention is that Form data from a host legacy application can be associated with GUI controls on a Form displayed in the Web environment.

Yet another feature of the present invention is that Form data can be obtained from GUI Controls in the Web environment and returned to a legacy host application.

An advantage of the present invention is that a user is able to turn off the HTML presentation altogether and effectively use the browser as a transport layer for other ClientBuilder product applications with the data binding functionality. Moreover, a user can hide the browser and execute a Visual Basic application, which would communicate with the browser and the user never sees the browser.

Another advantage of the present invention is that the SCL can set various states of GUI Controls and associate data with them. The current state of the HTML has a limited subset of what is doable in terms of data logic handling.

Still other objects, features and advantages of the present invention will become readily apparent to those skilled in the art from the following detailed description, wherein is shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated of carrying out the invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modifications in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive, and what is intended to be protected by Letters Patent is set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system that could be used to develop files and to execute the same employing the steps of the method of the present invention.

FIG. 2 is a print of a computer screen display from a 3GL legacy application Form for TRIPS, a report for tracking employee expenses, which is convertible by using the method of the present invention.

FIG. 3 is a print of a computer screen display of the same Form for TRIPS after adding visual controls using the Development Studio.

FIG. 4 is a print of a computer screen display after employment of the method of the present invention.

FIGS. 5A through 5C combined Form a flow chart illustrating the process for development of files for use with the method of the present invention.

FIGS. 6A through 6K (intentionally omitting "6II") illustrate a run-time process that includes the steps performed by the method of the present invention.

FIG. 7 is a diagram of the process of the present invention.

DETAILED DESCRIPTION OF ONE EMBODIMENT

The present invention integrates the popular Web browsers with legacy applications in order to provide Form presentation capabilities not supported using HTML, which is today's most popular Web language. This means that one can create a unified GUI front-end "look and feel" for even the most complex applications. The disclosed method is ideal for building and interfacing powerful desktop client applications with 3GL and LINC legacy applications.

The SCL language is used by the PowerClient product to control the display of Forms in the PC environment. Since this language completely characterizes a legacy Form for the purposes of display in the normal PC environment, including the legacy host application data field with which each GUI element is associated, a decision was made to use it as the means by which the Form is displayed in a Web browser. SCL Text is embedded into an HTML page for display in a Web browser environment, and the data entered by the user is returned to the legacy application.

In order to display embedded HTML and communicate with the legacy application on a host, two cooperating programs are required. For the Web browser environment, an ActiveX control was developed and is referred to herein as SCL Web Control ("SWC") program. The SWC program is an ActiveX compliant control used to communicate with either a Netscape or Microsoft Web browser. ActiveX is a software technology sponsored by Microsoft Corporation.

ActiveX controls are invoked in the browser environment by a particular HTML construct (the OBJECT tag). To generate an HTML page with the OBJECT tag, a program was developed that can be invoked by a Web server, which is referred to herein as a Web Agent program. The Web

Agent program also communicates with the legacy host application to act as a communications switch for data going from the host application to the SWC program for display to the user and from the SWC program to the host application when the user submits the Form.

The OBJECT tag construct allows the passing of parameters to an ActiveX control when it is invoked. Therefore, SCL Text is included for a legacy Form as one of the parameters to the SWC program. A second parameter to the SWC program is the initial data for the Form received from the host legacy application. The SCL Text passed to the SWC program contains GUI Control specifications. A part of each such specification is the name of the host legacy application data element with which the GUI control is associated.

The SWC constructs a set of GUI Controls corresponding to the GUI Control specifications in the SCL Text. Using the part of each such specification that indicates which application data field with which the control is associated, it places initial data from the initial data list into the GUI control. The initial form data is in the format of name/value pairs, where the name is that of a legacy application data element, so it is necessary for the control to make an association between this data name and the GUI Control.

When the user completes interaction with the Form, the SCL Web Control acts much as it does in PowerClient in that it gathers data from those GUI Controls associated with Data Names and formats it for return to the host legacy application. In this case, since the environment is the Web, the formatting is different than in the PowerClient product. The GUI Control-data name associations are used to locate those controls containing data for the legacy application. These values are extracted from the GUI Controls. A URL is then constructed, containing name/value pairs, where the name is the application Data Name. The URL also contains information about the name of the Form and its host application. The URL is sent to the Web Agent program, which reformats the URL into the normal PowerClient product host application data buffer as described in a problem statement.

At this juncture of the description several definitions are added to assist in the understanding of the present invention.

Application shall mean a program written by a user which accomplishes some operation.

Command shall mean an instruction to perform an operation. In the Web Agent (defined hereafter) context, the Command operation is to obtain ("Open") a host Form or to send the results of an entry of data into the Form back to the application ("Transmit").

Data Name shall mean the name of a host application datum. That is, is the identification given to a field on a host screen.

Data Value shall mean the value of a host application datum. That is, the value associated with a field on a host screen.

Form shall mean the visual display elements of an application containing fields for entry and display of the application.

GUI Control shall mean a visual element of a GUI display, such as an edit box or a list box. Other examples include buttons, list boxes, check boxes and combo boxes.

Host Reply Definition (HRD) shall mean a file used in the PowerClient 3GL environment that maps characters in the data stream from the host with the fields and their Data Names in the modernized Form.

Partition or Partition Name shall mean a space in a repository, thereby providing a means for categorizing data in the repository. In particular, it shall mean a name given to represent a series of Forms associated with a 3GL/LINC (i.e., Legacy) application.

Repository Object shall mean such things as SCL Text (defined hereafter), list box data, an image, etc.

SCL Construct shall mean a valid production of the SCL language's grammar, i.e., an SCL Text (defined hereafter) statement.

SCL Control shall mean an SCL Construct that describes a particular GUI Control, such as an edit field, list box, etc.

SCL Web Control shall mean an ActiveX based control used in a PowerClient run-time environment.

SCL Text shall mean a collection of SCL Constructs. SCL is a Unisys proprietary language. SCL Text is used to describe GUI Controls to be rendered within a browser.

SCL Files shall mean those files that contain SCL Text, which are referred to as an object in a repository.

Script shall mean a sequence of instructions used to establish connectivity with a host computer and a specific application of the host.

Uniform Resource Locator (URL) shall mean an identifier for locating a resource on the Web.

Web Agent shall mean the PowerClient module that interprets special URL requests passed to it by the Web Server (defined hereafter). It uses information in the special URL to obtain data from the host for a particular Form and returns it to the Web Control via the Web Server and Web browser. It is also a series of both client/server components that permit LINC/3GL applications to have access over the Web.

Workstation Driver File (WDF) shall mean a file used in the PowerClient LINC environment that maps characters in the data stream from the host with the fields and their Data Names in the LINC Form.

Referring now to FIG. **1**, a client/server system configuration is illustrated wherein a host or mainframe **10** has terminals **11** and **12** coupled thereto and network connection **13** coupling to clients **14**, **15** and **16**. The network connection **13** may typically comprise a TCP/IP or any other proprietary protocol. The host **10** could be any computing system capable of operating in a client/server environment, such as for example any Unisys or IBM computer. The host **10** is coupled to a network server repository **17**, the client **14** (also referred to herein as an NT Web Server) is connected to a client repository **18**; and, the client **16**, which in the illustrated embodiment is used for development, is coupled to a development repository **19**. The clients **14**, **15** and **16** could typically be any currently available PC capable of executing the Windows 95 or NT operating system. However, it is required that the client **14** be able to execute the Windows NT operating system.

The host **10** is capable of executing software programs including LINC and 3GL legacy programs. The client **14** is capable of executing software programs including INFOConnect (transports), PowerClient and Web Agents. The client **15** is capable of executing software programs such as SCL Web Control and Web browsers. The client **16** is capable of executing software programs such as PowerClient and INFOConnect. In addition to those programs alluded to hereinabove, the client **16** is capable of executing many of the more popular and widely-used programs such as PowerBuilder and Visual Basic.

The Web Server repository **18** stores Forms that are distributed to clients using Web browsers. The repository **18** is the database that contains LINC Form objects, image

objects, Script files and data files that are down-loadable from the host system, as required.

The network server repository **17** holds host application Forms, and it provides version control for Development Studio Forms.

The Development Repository **19** is used as a database for the development process and in particular stores LINC Form objects, image objects, data files and scripts. Moreover, the development repository **19** contains the objects and scripts necessary to develop and properly display Forms in the Web browser. As one begins modernizing their applications, developers can take advantage of the repository **19** to share tasks. When a new Form is stored in this repository, it is immediately available to other development environment users.

The INFOConnect program includes three parts of a suite that runs with PowerClient, and they are the Unisys MT Emulator, the UTE Emulator and the IBM 3270, all of which are available from DCA, Inc., of Cincinnati, Ohio. PowerClient is a program available from Unisys Corporation of Blue Bell, Pa., assignee of the present invention. PowerClient includes **10** components: Code Generation Assistants (two), 3GL Work Bench, LINC Work Bench, MAPPER, Development Studio, Repositories on the Mainframe (two), CBT and Web Agent.

Referring now to FIG. **2**, a print of a screen display of a Form for a 3GL legacy application is illustrated. When a client user calls up the INFOConnect and logs onto the server and specifies TRAVEL, this particular Form entitled TRIPS appears on the screen. It is a typical Form to be completed by an employee of an organization for reimbursement of travel expenses. Each field of this Form is depicted by a space between opposing arrowheads. For example, the field entitled EMPLOYEE SSN is that space **20** between opposing arrowheads **21** and **22**, and includes a display screen cursor **23**. The next field LAST NAME is that space **24** between opposing arrowheads **25** and **26**. The remaining fields of the Form are similarly depicted. There are a total of fifteen (15) fields on this Form.

Preparatory to modifying the TRIPS Form using the method of this invention, the user captures this Form using the combined facilities of the INFOConnect Emulator and the PowerClient Development Studio (PDS). The user then creates Data Names for each field of the Form. SCL syntax will contain each of the Data Names created. For example, for the Form shown in FIG. **2**, the following information will be created and stored in the development repository **19**, and is to be used in the SCL generation process. The user would indicate the data entry fields and the static text in the Form.

SCL	SCL OFFSETS		
DATANAMES	Row	Column	Length
EMPSSN	3	19	20
LASTNAME	4	19	25
CREATOR	5	19	10
•			
•			
•			

The user/creator has a great deal of flexibility and can create a push button or a window for a specific field, can change names or use previous text, etc. The output is stored in the development repository **19**.

Referring now to FIG. **3**, a print illustrates a computer screen display of a modernized version of the 3GL form shown in FIG. **2** and described hereinabove. Notice that this modernized Form includes windows for entering data, wherein window **20** corresponds to the space **20** in FIG. **2** for entry of an Employee SSN. Window **24** corresponds to the space **24** in FIG. **2**. A TRANSMIT button **28** is added by the modernizing process.

Referring now to FIG. **4**, the modernized Form shown in FIG. **3** is now embedded within a Web browser display, having been stored in the repository **18** and retrieved by a Web browser at client **15** using the method of this invention. Corresponding reference numbers identify like components.

Referring now to FIG. **5A**, which is the first of a three-sheet drawing showing a flow chart of the process for development of files for use with the method of the present invention. The process begins in the client **16** with a start bubble **50** followed by an inquiry as to whether or not Forms for the host application exist in the development repository **19** (diamond **51**). If the answer to this inquiry is yes, then the Development Studio is invoked (block **52**). On the other hand, if the Forms do not exist in the development repository, another inquiry is made as to whether or not Forms for the host application exist in the host repository **17** (diamond **53**). If the Forms do not exist on the host, then the Development Studio is invoked (block **54**) and with the use of the Development Studio, the host application is invoked (block **55**).

If the host application Form does exist in the host repository **17** (yes leg of the diamond **53**), then the PowerClient software is used to request a download of the Forms and the corresponding HRD/WDF files from the host repository **17** (block **56**). Next, the Forms and the HRD/WDF files are placed in the development repository **19** (block **57**). After this, the Development Studio is invoked (block **58**). Upon completion of the step **52** or the step **58** a branch is made to a later point in the process at a connector A, which will be described shortly. Upon completion of the step **55** a branch is taken to FIG. **5B** at a connector B.

Referring now to FIG. **5B** at the connector B, the next step in the development process is to capture a Form by interaction with the host application (block **60**). For the Form thus captured, an SCL Text and an HRD file are generated using the Development Studio (block **61**). Following this, the SCL Text and the HRD file are placed in the development repository **19** (block **62**). An inquiry is then made as to whether or not there are more Forms (diamond **63**). If the answer is yes, then a return is made back to the process block **60**. This cycle repeats itself until all Forms have been processed, and an exit is taken on the no leg of the diamond **63**.

The process of updating and modifying of the Forms begins when an inquiry is made as to whether or not there are more Forms in the Partition to be modified (diamond **64**). Note that the connector A from the preceding FIG. **5A** is also an input to the diamond **64**. If the answer to the diamond **64** inquiry is yes, then the developer or user opens the Form by using the Development Studio (block **65**). On the other hand, if there are no more Forms in the Partition to be modified, then a branch is made to a later point in the process as illustrated by a connector C. Next, the developer modifies the GUI Controls as desired (block **66**). Following this, the process illustration continues on the next sheet of the drawings, FIG. **5C** in particular, as illustrated by a connector D.

Referring now to FIG. **5C** at the connector D, an inquiry is made as to whether or not there are more Data Names in the Form (diamond **68**). If the answer to this inquiry is yes,

then the developer verifies that there is an associated GUI Control and assigns a Data Name to the GUI Control (block **69**). Once all of the Data Names in the process have been verified, then an exit is taken from the no leg of the diamond **68** to another step in which the developer uses the Development Studio to generate a new SCL Text (block **70**). Following this, the developer uses the Development Studio to place the new SCL Text in the development repository **19** (block **71**). On completion of this step, a return is made back to that part of the process illustrated in FIG. **5B** at the connector A, and in particular to the inquiry in the diamond **64**. Once all of the Forms in the Partition have been modified, then an exit is taken from the no leg of the diamond **64** at the connector C and continues in FIG. **5C**, whereupon the Partition containing the SCL Files and the HRD/WDF files is exported from the Development Repository **19** (block **72**). The exported Partition is imported into the Web Server repository **18** (block **73**) and the process ends (bubble **74**).

At this juncture the SCL Text for the Forms in the last application have been developed in accordance with the directions of the developer/user.

Referring now to FIG. **6A**, the first of a ten-sheet drawing is shown that illustrates the run-time process, which includes the steps of the present invention. The process begins in the client **15** with a start bubble **80** followed by a process step performed in response to entry or selection of an URL that contains certain elements, among which are an open Command, a Form name, a Script name and a Partition name. A Web browser forwards the URL to the Web server **14** without otherwise interpreting it (block **81**). Next, within the Web Server **14**, the URL is passed to the Web Agent (to which it is addressed) and awaits for a response from the Web Agent (block **82**).

The Web Agent then parses the URL from the Web Server **14** to obtain the Command which is embedded within it (block **83**). Next, an inquiry is made as to whether or not the Command is "Open" (diamond **84**). If the answer to this inquiry is no, then a branch is taken to a later point in the process as depicted by a connector R. On the other hand, if the answer to this inquiry is yes, then the Web Agent further parses the URL (block **85**) to obtain the following:

1.) the Partition in the repository **18** to be used; and,

2.) the Script for communicating with the host.

The process illustration continues in FIG. **6B** at a connector G.

Referring now to FIG. **6B** at the connector G, an inquiry is made as to whether or not an open connection to the application on the host **10** exists (diamond **88**). If the answer to this inquiry is yes, then the Web Agent uses the Script information to locate an open connection to the application on the host **10** (block **89**) On the other hand, if the answer to this inquiry is no, then the Web Agent uses the Script information to open a connection to the host **10** (block **90**). After completion of either the step **89** or **90**, the Web Agent requests Form data for the requested Form over the open connection (block **91**). After this, and using the Partition information from the URL, the Web Agent retrieves the SCL Text and the WDF or HRD file developed for the application Form from its repository **18** (block **92**). The process illustration continues on the next sheet of the drawings as denoted by a connector H.

Referring now to FIG. **6C** at the connector H, the Web Agent parses the WDF or HRD file and associates Data Names from it with corresponding Data Values from the returned application Form data into Data Name/Data Value pairs (block **93**). Next, the Web Agent generates an HTML page having an object reference to the SCL Web Control, whose parameters include:

1.) The SCL Text itself;

2.) A list of the Data Name/Data Value pairs; and,

3.) Other information necessary for the display of the SCL and interpretation of the Data Name/Data Value pairs (block **94**).

The Web Agent then returns the generated HTML page to the Web server (block **95**). Following this, the Web server, which has been waiting for the response from the Web Agent, returns the HTML page to the Web browser (block **96**). The process illustration continues in the next sheet of the drawings within the PC **15**, as denoted by a connector I.

Referring now to FIG. **6D** at the connector I, the Web browser parses the HTML page (block **98**). Upon encountering the object reference to the SCL Web Control, an inquiry is made as to whether or not the SCL Web Control is present (diamond **99**). If the answer is no, then SCL Web Control is downloaded (block **100**). Once the SCL Web Control is present, the browser invokes the SCL Web Control and passes to it the parameters from the HTML page and other necessary information, including references to the Web browser's window (block **101**). Following this, the SCL Web Control parses the SCL Text parameter passed to it to obtain information relating to the GUI Controls to be displayed (block **102**).

An inquiry is next made as to whether or not there are more SCL Constructs with a GUI Control to be displayed (diamond **103**). If the answer to this inquiry is no, then a branch is made to a later part of the process, which will be described later, as designated by a connector J. On the other hand, if the answer to this inquiry is yes, then the SCL Web Control uses the control type and positioning information from the SCL Construct to paint a GUI Control of the designated type at the designated position in the window whose reference was passed to it as a parameter (block **104**). Next, the SCL Web Control uses font information from the SCL Construct to set font characteristics of the GUI Control (block **105**). The process illustration continues in the next sheet of the drawings as denoted by a connector K.

Referring now to FIG. **6E** at the connector K, the SCL Web Control uses foreground/background color information from the SCL Construct to set color characteristics of the GUI Control (block **106**). Following this step, a return is made back to the diamond **103** (via a connector T to FIG. **6D**) for processing the next SCL Construct. Once all of the SCL Constructs have been processed, a branch is taken via the connector J to a process step wherein the SCL Web Control parses the SCL Text parameter passed to it to obtain information relating to Data Names for the GUI Controls to be displayed (block **107**). Following this, an inquiry is made as to whether or not there are more constructs that have a Data Name (diamond **108**). If the answer to this inquiry is yes, then the SCL Web Control locates the corresponding GUI Control and makes an association between the Data Name and the GUI Control (block **109**).

The SCL Web Control then uses information from the SCL Text and a Data Value from the Data Name/Data Value list to set initial state information and contents of the associated GUI Control (block **110**). Next a return is made back to the diamond **108** for processing the next construct. Once all of the constructs have been processed, a branch is taken to a process step wherein the SCL Web Control parses the SCL Text parameter passed to it to obtain references to objects stored in the Web Agent repository **18** (block **111**). The process illustration continues on the next sheet of the drawings as denoted by a connector L.

Referring now to FIG. 6F at the connector L, an inquiry is made as to whether or not there are more references to a Repository Object (diamond 113). If the answer to this inquiry is no, then a branch is made to a later-described part of the process as denoted by a connector Q. On the other hand, if the answer to the inquiry is yes, then the SCL Web Control constructs a message to the Web Agent for the object containing:

1.) The name of the object from the SCL Text; and,

2.) The Partition name from the original URL, which was derived in step 81, FIG. 6A.

Within the Web server 14, the Web Agent parses the message received to obtain the name of the requested object and the name of the Partition in which it resides (block 115). Next, the Web Agent uses the name of the object and the Partition in which it resides to obtain the contents of the object from the Web Server repository 18 (block 116). After this, the Web Agent constructs a response message containing the contents of the object from the Web Server repository 18 (block 117). The process illustration continues in the next sheet of the drawings as denoted by a connector M.

Referring now to FIG. 6G at the connector M, the Web Agent returns the response message to the SCL Web Control, which has been waiting for this response (block 120). Within the client 15, the SCL Web Control extracts the requested object contents from the response message received from the Web Agent and associates it with its Data Name (block 121). Next, the SCL Web Control locates the GUI Control that is associated with the Data Name (block 122). The SCL Web Control then places the contents of the requested object into the GUI Control thus located (block 123). At this juncture of the process a return is made back to the diamond 113 in FIG. 6F, as denoted by a connector L, to process the next reference to a Repository Object.

The connector Q from the no leg of the diamond 113 (FIG. 6F) intercepts the process at this point. In response to inputs by a user of the client 15, the Web control interprets user inputs and uses them to navigate from one GUI Control to another (block 124). The process illustration continues on the next sheet of the drawings as denoted by a connector N.

Referring now to FIG. 6H at the connector N, in response to inputs by a user of the client 15 indicating completion of interaction with the displayed GUI Controls, the Web control interprets such inputs and invokes the process that sends the data to the host application (block 126). This process begins at a process step where the SCL Web Control examines each GUI Control that it has previously painted (block 127). Following this, an inquiry is made as to whether or not there are more GUI Controls associated with a Data Name (diamond 128). If the answer to this inquiry is no, then a branch is made to a later point in the process as denoted by a connector 0. On the other hand, if the answer to this inquiry is yes, then the SCL Web Control obtains the contents of the GUI Control and places this value and the Data Name into a buffer (block 129). Upon completion of this step a return is made back to the diamond 128 to inquire again if there are more GUI Controls associated with a Data Name. When all GUI Controls have been completed, an exit is taken to the next sheet of the drawings as denoted by the connector 0.

Referring now to FIG. 6J at the connector 0, and still within the client 15, the SCL Web Control constructs a URL of type POST, addressed to the web server named in the original URL (derived at step 81, FIG. 6A), containing:

1.) The buffer Data Name/Data Value pairs;

2.) The host application Form name;

3.) A Command ("Transmit" in this case);

4.) Partition name; and,

5.) Script name (block 131).

The SCL Web Control then passes the URL to the Web browser (block 132). Next, the Web browser sends the URL to the Web server 14 (block 133). Within the Web server and in response to the URL from the previous step, the web server passes the URL to the PowerClient Web Agent (to which it is addressed) and waits for a response (block 134). Next, the Web Agent parses the URL to obtain the Command (block 135). After this, an inquiry is made as to whether or not the Command is "Transmit" (diamond 136). If the answer to this inquiry is no then an error message is issued (bubble 137). Note that the connector R, which is from the diamond 84 (FIG. 6A) and an indication that the Command is not "Open", is another input to the diamond 136. The error message is issued since the Command is neither an "Open" nor a "Transmit", which are the only two choices. On the other hand if the answer to this inquiry is yes, then the process continues on to the next sheet of the drawings as depicted by a connector P.

Referring now to FIG. 6K at the connector P, on determining that the Command is "Transmit", the Web Agent further parses the URL to obtain:

1.) The Data Name/Data Value buffer;

2.) The name of the Form with which this data is associated;

3.) Partition name; and,

4.) Script name (block 140).

The Web Agent then uses the name of the host application Form thus obtained to access the HRD or WDF object for the Form from the Web Agent repository 18 (block 141). Next, using the HRD or WDF files as a guide, the Web Agent extracts the fields from the Data Name/Data Value buffers and constructs a buffer for transmittal to the host application in the host 10 (block 142). After this, the Web Agent sends the host data buffer to the host application using the Script name obtained in step 140. Since the Command is "Transmit"the connection will have been established by a previous "Open" Command (block 143). It waits for a response from the host 10, which response includes the name of the next host application Form. Finally, the Web Agent retrieves the SCL Text and the HRD or WDF file developed for the next host application Form from the repository 18. After completion of this step the process repeats itself by returning to the process step 93 (FIG. 6C) as denoted by the connector H.

The method of the present invention is useful in a computing system having at least one server and a multiplicity of clients coupled thereto by means of a network. The server includes a CPU executing a Web Server program and has a repository coupled thereto for storing description language of a Form to be displayed. The Web server is coupled to a host having a CPU executing a legacy application containing the Form, all of which is illustrated in FIG. 1 and described hereinabove. At least one of the clients executes a Web browser program. The method of the present invention operates in the server and the client for supporting enterprise application data binding. As described hereinabove, the program running in the client is referred to as the SCL Control and the program running in the Web server is referred to as the Web Agent.

Referring now to FIG. 7, a summary of the method of this invention is illustrated. The process begins with a start bubble 150 followed by a step of the browser forwarding an URL entered by a user to the Web Agent without otherwise interpreting it (block 151). The Web Agent opens the Forms and requests a first Form (block 152). Next, data binding is generated by associating data names with data values received from the host, which is sent to the client (block

153). The SCL Control program then processes the data binding by locating corresponding GUI Controls and making an association between each of the data names and corresponding GUI Controls (block **154**). Following user interaction with the displayed GUI Controls, the SCL Control program obtains the contents of each of the corresponding GUI Controls associated with a data name and places a data value/data name pair into a buffer (block **155**). These results are passed to the server where the Web Agent processes the contents of the buffer and sends it to the host (block **156**). The server then retrieves a next Form from the host. Accordingly, from the foregoing the GUI Controls are displayed containing values and states from the Form.

Although the invention has been described with reference to a specific embodiment, this description is not meant to be construed in a limiting sense. Various modifications of the disclosed embodiment as well as alternative embodiments of the invention will become apparent to one skilled in the art upon reference to the description of the invention. It is therefore contemplated that the appended claims will cover any such modifications of embodiments that fall within the true scope of the invention.

What is claimed is:

1. In a computing system having at least one server and a multiplicity of clients coupled thereto by means of a network, said server having a CPU executing a Web Server program and having a repository coupled thereto for storing description language of a Form to be displayed, at least one of said clients executing a Web browser program, a method operating in said server and said at least one of said clients (hereafter said client) for supporting enterprise application data binding, said method comprising the steps of:

a. in said server opening said Forms and requesting a first Form;

b. in said server generating data binding of data names with data values and sending to said client;

c. in said client processing said data binding with GUI Controls and sending to said server;

d. in said server taking contents of GUI Controls and generating results;

e. in said server processing said results and getting next Form from said Forms;

whereby said GUI Controls are displayed containing values and states from said Form.

2. The method as in claim **1** wherein step d thereof further includes for each GUI Control associated with a data name, obtaining contents of said GUI Control and placing value thereof and data name into a result buffer.

3. The method as in claim **2** further including the step of constructing a response URL containing said result buffer and a command.

4. The method as in claim **3** further including the step of passing said response URL to said Web browser.

5. The method as in claim **1** wherein step e thereof further includes the step of parsing said results to determine said command.

6. The method as in claim **5** further including the step of, in response to said command, accessing said file developed for said legacy application Form and, using information from said file as a template, extracting values from said result buffer to construct a legacy application buffer for transmittal to said host.

7. The method as in claim **5** further including the step of transmitting said legacy application buffer to said legacy application at said host and, in response to a next Form invocation from said legacy application, retrieving from said repository Form description language text and files developed for said next Form.

8. In a computing system having at least one server (hereafter "said server") and a multiplicity of clients coupled thereto by means of a network, said server having a CPU executing a Web Server program and having a repository coupled thereto for storing description language of a Form to be displayed, a host having a CPU executing a legacy application containing said Form, and at least one of said clients (hereafter said client) executing a Web browser program, a method operating in said server and said client for supporting enterprise application data binding, said method comprising the steps of:

a. in said server opening said Forms and requesting a first Form from said host;

b. in said server generating data binding by associating data names with data values received from said host and sending to said client;

c. in said client processing data binding by locating corresponding GUI Controls and making an association between each of said data names and said corresponding GUI Control;

d. in said client obtaining contents of each of said corresponding GUI Controls associated with a data name and placing value and data name into a buffer;

e. in said server processing contents of said buffer and sending to said host

f. in said server retrieving a next Form from said host;

whereby said GUI Controls are displayed containing values and states from said Form.

9. The method as in claim **8** wherein step a thereof includes receiving an URL from said Web browser and parsing said URL to obtain a command.

10. The method as in claim **9** further including in response to said command, further parsing of said URL to obtain partition in said repository and script for communicating with said host.

11. The method as in claim **10** further including the step of retrieving from said repository Form definition language text and a file developed for said Form for the purpose of mapping elements of a data stream from said legacy application to application data names contained in said Form definition language text.

12. The method as in claim **11** further including the step of parsing said developed file for said Form and associating data names of said legacy application with corresponding legacy application data values from a data stream returned from said host, thereby forming data name/data value pairs.

13. The method as in claim **12** further including the step of constructing an HTML object reference to said client, with parameters including said data name/data value pairs and said Form description language text.

14. The method as in claim **13** further including the step of generating an HTML page containing said object reference to said client.

15. The method as in claim **14** further including the step of returning said HTML page to said Web browser program.

16. The method as in claim **1** wherein step c thereof further includes said client parsing said Form description language text parameter passed to it to obtain Constructs containing information relating to data names for said GUI Controls to be displayed.

17. The method as in claim **16** further including for each said Construct that includes a data name, locating a corresponding GUI Control and making an association between said data name and said GUI Control.

18. The method as in claim **17** further including the step of using information from said Form description language text and a data value from a data name/data value list for setting initial state information and contents of said GUI Control.

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